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THE PRACTICAL TEACHER

'AN APOSTLE OF HERBART.'
(See page 249.)

CONTENTS
OF THE
NOVEMBER NUMBER.

	PAGE
COMING MEN: MR. ROBERT G. DICKSON, M.A.	241
WELL-KNOWN TEACHERS AT WORK: MR. BENJAMIN H. BARBER	243
AN APOSTLE OF HERBART	249
OUR NEW COMMERCIAL SCHOOLS. I.—DALSTON	250
HOW TO OBTAIN AN OXFORD DEGREE. By A Practical Teacher	252
OUR SEARCH-LIGHT COLUMN	254
EDUCATION IN ENGLAND. N.U.T. Notes, &c. By T. B. Ellery	255
EDUCATIONAL NOTES. By Catherine I. Dodd	257
E.I.S. NOTES. By Jas. Paterson	258
ELEMENTARY AND SECONDARY SCHOOLS	258
NOTES FROM THE NORTH	259
EDUCATION ABROAD. By E. E. Fournier d'Albe, B.Sc., &c.	261
NOTES OF TWO LESSONS. By William Done, B.A.	262
FULL NOTES OF A LESSON ON THE CATERPILLAR AND THE BUTTERFLY. By William Done, B.A.	264
THE PRINCIPLES AND PRACTICE OF CLASS TEACHING	265
CLASS LESSONS IN DOMESTIC ECONOMY. By Ethel R. Lush	266
NEW PROBLEMS IN ARITHMETIC	268
THE INSPECTOR'S NOTE BOOK. By An Inspector of Schools	269
A VISIT OF INSPECTION IN DRAWING	270
THE L.L.A. OF ST. ANDREWS. B.—The Department of Philosophy. By Thos. Cartwright B.A., B.Sc. (Lond.)	271
LONDON MATRICULATION. By R. C. B. Kerr, B.A. (Lond.), and E. J. Schwartz, M.A., B.Sc.	274
NOTES ON PHYSIOLOGY. By Walker Overend, M.A., M.D., &c.	276
OUR PUPIL TEACHERS' & SCHOLARSHIP COURSE. By A. T. Flux	277
OUR NEW CERTIFICATE COURSE FOR 1900. By G. Collar, B.A., B.Sc.	282
CHEMISTRY NOTES. By Thos. Cartwright, B.A., B.Sc. (Lond.)	286
PHYSIOGRAPHY NOTES	287
NOTES ON THEORETICAL MECHANICS. By F. Castle, M.I.M.E.	288
MATHEMATICS. Stages II. and III. By G. A. Baxandall	290
HEAT. By Edwin Edser, A.R.C.S., F.Ph.S.	291
FRENCH AND GERMAN PRIZE COMPETITION. Prize Editor: W. T. Thompson, B.A. (Lond.)	292
OUR BOOKSHELF—'AT THE SIGN OF THE PAPER KNIFE'	293
THE EDITOR'S TABLE AND DEATH OF Mr. C. J. ADDISCOTT	295

COLOURED SUPPLEMENT
PRESENTED WITH THIS NO.:
THE CATERPILLAR AND BUTTERFLY.

VOL. XIX No. 5.

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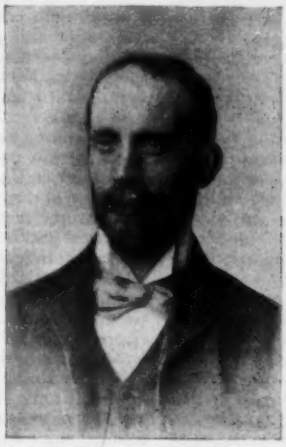
COMING MEN.

MR. ROBERT G. DICKSON, M.A.,

President of the Scottish Assistant Teachers' Association.

IT was an ideal summer afternoon when I arrived in Edinburgh, armed with a commission to interview the subject of this sketch. But, as usual, Edinburgh fascinated me, and I loitered on my way; I was in no hurry to leave the queenly Princes Street and its leisurely promenaders. I could not refrain from looking reverently on the cultured-looking old gentlemen I passed on my way. I felt that some of them might have a connection, however distant, with the literary giants of Edinburgh's glorious past. As I turned my gaze on the inspiring scene, the rock-perched castle and the old grey tenements clinging to the long ridge upon which had often looked the mighty Carlyle, once a member of our noble profession, the romantic Scott, and the impassioned Burns, I could not but think of the ancient city's goodly heritage. As I stood in St. Cuthbert's churchyard, by the grave of that restless literary soul, De Quincey, and pondered over the names and deeds of the long roll of penmen who had once lived in Edinburgh, I fancied there could be no need here for schools and schoolmasters, as there could be no ignorance, no squalor, no wickedness in a town with so much natural beauty and such a noble past; but, alack and alas! I found signs of all three within a stone's-throw from the churchyard gates.



MR. R. G. DICKSON, M.A.

I breathed freely, however, when, beyond the green links of Bruntsfield, I found the home of my victim. The room into which I was ushered betokened work with which I was familiar; many volumes stared out from their places on the shelves; copies of the PRACTICAL TEACHER, and other educational contemporaries were hobnobbing on the table with the latest Educational Blue Book; bundles of papers lay on the desk as if work had been only momentarily suspended. Before I had time to see more, Mr. Dickson entered, and greeted me very heartily, but I found him somewhat reluctant to submit to the inevitable operation at my hands.

Some readers are not satisfied unless they can have a portrait of a 'Coming Man,' on which they can exercise their skill in physiognomy in tracing his past and foretelling his future; such may depend on the accompanying photograph to show them what Mr. Dickson is like; it will form a more reliable basis for their labours than any feeble pen-portrait would do. Others delight to have some biographical facts with which to strengthen their theories on the influence of environment; such must be content with the following necessarily condensed paragraph, based on facts fortunately formerly gleaned from one of Mr. Dickson's most intimate friends, and which I am glad to be able to substitute for the replies to those necessary but painfully familiar queries in the interviewer's catechism. A few care neither for looks nor for training; they label a man according to his views on certain points on which they themselves have decided opinions; such will find sufficient in the succeeding paragraphs to judge Mr. Dickson by. But all must miss the effect of the living presence of such a tireless and resourceful educational enthusiast as he undoubtedly is.

The fact that Mr. Dickson was born at Berwick-on-Tweed may throw some doubt upon Scotland's claim upon him; his early removal to Haddington, the native town of the reformer, John Knox, will prove at least that Scotland nurtured him, and, if the spirit of a great man may be imbibed by the schoolboys of three centuries after, may also go far to explain the fearless reforming spirit exhibited by much of the work done by Mr. Dickson. Ever since he could read and write, he seems to have had one principle, *nulla dies sine linea*. As a bursar he was promoted from the Primary School in Haddington to the Knox Institute there, and, as gold medallist, he left it for the University and the Training College. The grounding he received, especially in English and Classics,

must have been as sound as his ability was high, if we may judge by the distinguished position he took during his course in Moray House, and by the prizes he gained at Edinburgh University, where he graduated as M.A.—prematurely, mayhap, as his career would have justified him in going in for Honours in the Department of Philosophy.

Though he has not yet passed o'er half life's meagre span, he is second master in one of the Edinburgh Board schools and head master in one of the evening schools, and his success in both of these positions amply justifies his choice. Even his arduous duties as a teacher have not hindered his pursuit of knowledge. Profound belief in the dictum, *qui non proficit, deficit*, made him devote himself to Science for several years at the Heriot-Watt College, where he specially distinguished himself in Chemistry among many able students.

'And now, Mr. Dickson,' said I, eager to get some weightier copy, 'I was much interested in some articles of yours which appeared in *Hand and Eye* a year or two ago. You might tell me something of your connection with Sloyd.'

'Well,' said Mr. Dickson, rescuing a galley-proof from the hands of his lively year-old, 'in the summer of 1892 I went through a course of wood Sloyd at the headquarters at Nääs, Sweden. I was so much impressed by what I heard from the enthusiastic Principal, and by what I was enabled to do with my own awkward hands, that, when I returned to Edinburgh, I developed, as a friend of mine used to say, decided symptoms of Sloyd fever; I supposed I raved and wrote incessantly about it. The fever proved to be of a most virulent type. The effect of the consequent infection was the desire, on the part of myself and others who had visited Nääs, for the formation of a Scottish Sloyd Association. (To such an extent do I carry my Home Rule principles, I thought that Scotland's educational traditions would be safest in our own hands.) Of this, when formed, I acted as Secretary for several years; and mainly through its influence manual training is now pretty general in the larger educational centres of Scotland. I am convinced from actual experience that manual training, based on sound principles, is most beneficial; but, if it is to be carried on properly, there must be a decided lessening of the numbers taught by one teacher and a further curtailment of the present school curriculum. The aim ought to be the development of all the faculties towards an educational perfection, the benefits of which may be felt in whatever work, mental or manual, the pupil takes up as his life-work. It cannot be called preparation for any particular trade; it is merely a rounding-off, a completion of what has hitherto been a too bookish education.'

'Now, Mr. Dickson, I find that most of the schools in Edinburgh accommodate over a thousand pupils; that some of them, indeed, come perilously near accommodating two thousand. What is your opinion of the large school?'

'I am glad you have asked me that question," replied Mr. Dickson, at once; 'it is one on which I, like most assistants, have very decided opinions. From the educational point of view, which is really the only one admissible, I hold that the monster school is highly detrimental to the truest interests of the pupil. A large school has too many of the characteristics of the factory in its internal economy. The head master of necessity becomes a recorder; it is impossible for him to attend properly to his purely clerical duties and at the same time to impress his individuality upon his pupils, which the head master of a school ought to be as free as he is willing to do. The subordinate teachers are mostly impelled by the highest motives, but, as the pupils are with them generally for one year only, and as they cannot be expected to have that power which age and experience of the world give, they fail to influence their pupils in the way strong head masters might do by that daily presence, that kindly and stimulating interest in the pupils' welfare which generally impress one so much in the smaller type of school.

'But, from the teachers' point of view, the question also deserves some consideration. Every large school narrows the chances of promotion, and therefore the chances of gaining experience. One large school means one head master, one headmistress, and one second master; two schools of a really workable size would mean two head masters, two head mistresses, and two second masters. Yet they build giant schools, enlarge and re-enlarge older and small schools, and wonder at the lack of lads of 'pregnant pairts' entering the teaching profession.'

'You mentioned lack of promotion. Would you advocate the recognition of the teaching profession as a department of the Civil Service?'

'No, I would not go that length,' replied Mr. Dickson. 'The incorporation of the teaching profession with the Civil Service would tend to re-introduce, in probably an aggravated form, much of the irksomeness of that Code routine of which we have lately been relieved; the tendency would be towards a cast-iron system which would go far to do away with that individualism which is so valuable in teaching. Teachers would probably find, too, that their individual freedom as to choice of district and choice of congenial work would be more curtailed than by the worst School Board which was ever elected, to say nothing of loss of liberty in political matters. To many the prospect of being Civil Servants is alluring, inasmuch as they would then know the possibilities of faithful and successful service, and, furthermore, they would be assured of an adequate provision for old age.'

'I suppose, Mr. Dickson, that, as President of the Scottish Assistant Teachers' Association, you may be looked upon as an expert on all questions affecting assistant teachers?'

'Well, I am not so sure about that,' said Mr. Dickson, who, though everybody knows he has performed his due share in making the membership of the S.A.T.A. what it now is—over 3,500—disclaims all credit for what he has so ungrudgingly done; 'but I may fairly claim to know something of the condition of the assistant, for both from my position as editor of the "Class Teachers' Contributions" in the *Educational News*, and as an official of the S.A.T.A., I have opportunities which few possess. Teachers are beginning to realise that there is such an individual as the "permanent assistant." Many who began their career with hope, who studied hard, who took good degrees, who were enthused with the true educational spirit, find that they have come to a dead wall, beyond which they cannot hope to pass; assistants they are, and assistants they are likely to remain during the term of their natural existence, unless they live to ages similar to those of the nomadic patriarchs, or unless some yet unknown bacillus works early havoc among those who are either head masters or second masters. They have been content to accept beggarly pittances, to satisfy their cultured tastes with such pickings of literary pabulum as they can afford, to deny themselves the pleasures of congenial society, and to put away from them all thoughts of domestic bliss, in the hope that some day their faithful and responsible service may obtain that recognition which would enable them to make their fancies realities. But their hopes are vain, and it is only natural to find sourness and embitterment, which must eventually affect the quality of education.

'Statistics gathered by the S.A.T.A. give unassailable evidence of the pitiful prospect. The Executive has already done good work among the School Boards of Scotland in inducing some of them, especially in rural districts, to give assistant teachers the monetary recognition to which their culture and their work entitle them. I was agreeably surprised, however, the other day, to learn from a correspondent that a School Board which advertised for a male assistant at £70 did not receive a single application, an encouraging sign that the minimum fixed by the S.A.T.A.—namely, £90—must be given by School Boards who wish to secure competent teachers. But I always try to impress upon teachers that there is only one way of obtaining what they deserve: they ought to have one aim, and only one, the advancement of education, for only *sub hoc signo, vincent*. The public will, I hold, meet teachers in a generous spirit when they realise, as they are doing, that they have the physical, intellectual, and moral welfare of their pupils thoroughly at heart. This method of advancing themselves may to some appear too slow, but let them do their part honestly and ungrudgingly, and be content with gradual improvement, remembering that *pas à pas on va bien loin*. Keeping the true aim well to the front, assistant teachers will find enough to do the while in their own Associations.'

'Do you not find that the S.A.T.A. and the E.I.S. are antagonistic?'

'The best answer to that question will be the fact that during the three years I have acted as Secretary of the Edin-

burgh Branch of the E.I.S. its membership has more than doubled, being now 550, and of that increase I am safe in saying no fewer than 75 per cent. are assistant teachers. Probably when the S.A.T.A. was started there was a feeling that the E.I.S. ignored the assistants, but the assistants were perhaps themselves to blame for not becoming members and making their influence felt. There is now, as there ought to be between two organisations ostensibly formed for the advancement of education, perfect harmony, and most assistant teachers find it to their interest to be members of both bodies. In fact, many are officials in both, while my six *confrères* on the General Committee of the Institute are recognised as worthy of being consulted on all questions of educational importance, and assistants are now asked to read papers at the E.I.S. Congresses. There need be no antagonism; the S.A.T.A. is necessary for the discussion of questions bearing directly on assistant teachers; after the settlement of details, both organisations should work hand-in-hand. I am convinced from the progress we have made during the past few years that ere long every assistant teacher in Scotland will be a willing worker in the E.I.S.; but I refuse to be contented until the teacher takes the position in Society to which he is entitled, and until we in Scotland can send a member or two to Parliament like our English brethren.'

At this point Mrs. Dickson appeared with a daintily-set tea-tray. Over a cup of delicious tea we had a delightful triangular chat. I felt more than ever, as I said 'Good-bye,' that Mr. Dickson is in reality a 'Coming Man,' a man of whom the educational world will hear more in the not distant future.

WELL-KNOWN TEACHERS AT WORK.

MR. BENJAMIN H. BARBER,

Angel Road Board School, Norwich.

OUT of the way of other large towns, with no railway passing through it, though little thought of by the people of England generally, Norwich is still the Mecca of East Anglia. The old city is well worth a visit, and is rich in historical associations. It possesses three railway stations, and each is a terminus, and one of the streets is called 'World's End.' The district around is as beautiful, in its way, as any part of England. The placid broads are within easy reach, and here yachting may be indulged in; the Wensum, Yare, and Bure, unsurpassed for their river scenery, are specially suitable for boating, and for watering places there are Yarmouth, Lowestoft, and Cromer. On Saint Monday there is, throughout the summer, a general exodus of one section of the citizens to these latter places at 'a shilling a time.'

Besides containing 'World's End,' however, Norwich is also noted for several other things. The manufacture of Colman's mustard, starch, blue, cornflour, etc., keeps a large section of the inhabitants busy. Its boots and shoes are very much in demand, and shopkeepers do not now, as heretofore, post up the notice 'No Norwich goods sold here.'

If a visitor to the city took careful note of what he saw, he would be struck specially by two things—The Beautiful Old Churches and The Beautiful New Schools. As it is our purpose to visit one of these latter, we pick upon the newest of all. As Norwich is a city of progress, its newest schools are naturally the best. A rapidly increasing population (very English) has made it necessary for the School Board to add greatly to the number of its schools, and the palaces of learning erected during the past few years are second to none. We wend our way northward to a rapidly growing neighbourhood, and have little difficulty in finding the Angel Road Schools. There is some difficulty in obtaining a good exterior view of the schools as a whole, but on entering the principal door we are at once struck by the magnificence of the place. The genial headmaster, Mr. Benjamin H. Barber, gives us a hearty welcome, and kindly offers to show us over the school, and to tell us all we wish to know about the methods of work, and any other matters which may be of use or interest to the readers of the PRACTICAL TEACHER. The headmaster of Angel Road Schools is well known in East Anglia for his enthusiastic devotion to the cause of education, and at once expresses to us how much he loves his work. Taking us to his private room he presents us with several photographs, thus helping us out of the difficulty of a long-worded description of the various parts of the school. The rooms used for teaching purposes, and their dimensions in feet, are as follows:—

Mixed School—On ground floor:
Central Hall, 92½ ft. × 44 ft.
Seven Class Rooms, 28 ft. × 22 ft.
Two Double Class Rooms, 42½ ft. × 22 ft.
Upstairs:
Laboratory, 45 ft. × 28½ ft.
Lecture Room and Physical Laboratory, 40 ft. × 30 ft.

Infants' School—On ground floor:
Central Hall, 42 ft. × 24 ft.
Two Double Class Rooms, 38 ft. × 20 ft.
Two Class Rooms, 25½ ft. × 20½ ft.

The school consists of three departments: Organized Science School, 80 boys; Mixed School, about 660 scholars, with girls only in Standards I. and II., and Infants. The Standards are divided into Upper and Lower Divisions. It is a centre for the Upper Standard boys from the schools in the neighbourhood. There are eighteen assistant teachers on the staff and six pupil teachers, besides visiting teachers for language and art subjects. Three assistants are employed solely in the Science School, and four assistants and three pupil teachers in the Infants' School. In the Organized Science School a four years course of instruction in Literary, Commercial, and Science and Art subjects is adopted, and in the Mixed School the usual subjects of the Education Code, with French in VI. and VII., and Mechanics V., VI., and VII.

The Class Subjects taken are: Varied Occupations in I. and II., Elementary Science in I., II., and III., Geography in III. to VII., and Grammar in IV. to VII.

Manual Instruction up to the present has been carried on under great disadvantages, as the boys have to attend the Technical School which is a mile and a half away. This, however, will shortly be remedied, as the Norwich School Board has decided to erect a building on the Angel Road grounds for this purpose.

After supplying us with the above particulars regarding the organization, Mr. Barber took us upstairs to see *The Laboratory* with its band of ambitious chemists hard at work, and much too busy and interested to take any notice of such insignificant objects as ourselves. The laboratory is capable of accommodating 35 students at each relay, and contains every convenience. It will be noticed from our illustration that there is a small fume chamber for each student, and large fume chambers and combustion hoods for general use. From the whole of these, noxious gases are extracted by means of a fan worked by a gas engine of 3 h.p. Any light articles accidentally placed in a fume chamber will suddenly pass away in the same direction as the fumes. The whole of the drain pipes to take off water from the sinks have movable covers, so that any blockage is easily discovered and removed. The floors are fire-proof concrete. The names on the bottles are etched for special re-agents, while for ordinary bottles varnished labels are used. The lighting by large windows on three sides gives great brightness to the place.

There are two *Balance Rooms* in which the students are able to do the weighing for the Practical Chemistry and Physics.

The *Physical Laboratory* is fitted up with three large tables, gas and water supply, and all such apparatus as is at present needed.

The *Lecture Room*, capable of accommodating 48 students, attached to which is the Preparation Room, is immediately connected with the Physical Laboratory. By throwing back a partition and darkening with appropriate blinds, a fine room, 40 ft. by 30 ft., for lantern lectures is obtained, and is frequently brought into use in teaching geography, etc., as well as for optical experiments. The fine oxy-ether lantern,

ANGEL ROAD SCHOOL (MIXED DEPARTMENT), NORWICH.

TIME TABLE.

Standard.	9 to 9.30.	9.30 to 9.40.	9.40 to 10.20.	10.20 to 10.50.	10.50 to 11.	11 to 11.30	11.30 to 12.	—	2 to 2.40.	2.40 to 3.20.	3.20 to 3.30.	3.30 to 4.	4 to 4.30.
I.	Hymn, Prayer, and 1st Registration. Religious Instruction.	Tables and Mental Arithmetic.	Arithmetic	Reading	Recreation.	Word Building	Dictation	MONDAY - - - -	*Girls*—Needlework / *Boys*—Arith.	Reading	Recreation.	Reading	Copy Books
II.			Arithmetic	Reading		Word Building	Dictation		*Girls*—Needlework / *Boys*—Arith.	Reading		Reading	Copy Books
III.			Arithmetic	Reading		Geography	Spell. and Dict.		Arithmetic	Drawing		Word Building	Singing
I.		Singing.	Arithmetic	Reading		11 to 11.45. Drawing	Criticism Less.	TUESDAY - - - -	Arithmetic	Elem. Science		Drawing	Brushwork
II.			Arithmetic	Reading		Drawing	Criticism Less.		Arithmetic	Elem. Science		Drawing	Brushwork
III.			Arithmetic	Geography		Drawing	Criticism Less.		Arithmetic	Elem. Science		Reading	Spelling
I.		Tables and Mental Arithmetic.	Arithmetic	Reading		Elem. Science	Singing	WEDNESDAY - - - -	*Girls*—Needlework / *Boys*—Arith. / 15 mins. mental	Word Building and Reading		Drawing	Recitation
II.			Arithmetic	Reading		Elem. Science	Singing		*Girls*—Needlework / *Boys*—Arith. / 15 mins. mental	Word Building and Reading		Reading	Geography
III.			Arithmetic	Reading		Geography	Spell. and Dict.		Elem. Science	Composition		Reading	Spelling
I.		Singing.	Arithmetic	Reading		Spell. and Dict.	Physical Exer.	THURSDAY - - - -	Arithmetic	Spell. and Comp.		Drawing	Brushwork
II.			Arithmetic	Reading		Spell. and Dict.	Physical Exer.		Arithmetic	Spell. and Comp.		Drawing	Brushwork
III.			Arithmetic	Reading		Geography	Composition		Arithmetic	Reading		Spelling	Dictation
I.		Tables and Mental Arithmetic.	Arithmetic	Reading		Spelling	Transcription	FRIDAY - - - -	Arithmetic	Elem. Science		Clay Modelling	Clay Modelling
II.			Arithmetic	Reading		Elem. Science	Transcription		Clay Modelling	Clay Modelling		Reading	Recitation
III.			Arithmetic	Recitation		Varied Occup.	Varied Occup.		Elem. Science	Drawing		Copy Books	Physical Exer.

ANGEL ROAD SCHOOL (MIXED DEPARTMENT), NORWICH.

TIME TABLE.

Standard.	9 to 9.15.	9.15 to 9.35.	9.35 to 9.45.	9.45 to 10.20.	10.20 to 10.50.	10.50 to 11.	11 to 11.30.	11.30 to 12.	—	2 to 2.15.	2.15 to 2.50.	2.50 to 3.	3 to 3.40.	3.40 to 4.15	4.15 to 4.30.
VII.	Hymn, Prayer, and 1st Registration.	Religious Instruction.	Examination of Homework.	Arithmetic	Arithmetic	Recreation.	Writing	Writing	MONDAY - -	Metric System or Mental Arithmetic	Model Drawing	Recreation.	Writing	3.40 to 4.5. Geography	4.5 to 4.30. Recit.
VI.*a*				Arithmetic	Arithmetic		Writing	Writing			Mechanics		Writing	3.40 to 4.15. Model Drawing	Writing down Homework 4.15 to 4.30.
VI.*b*				Writing	Reading		Arithmetic	Arithmetic			Arithmetic		Writing	Model Drawing	
V.*a*				Arithmetic	Geography		Mechanics	Writing			Reading		Writing	Model Drawing	
V.*b*				Arithmetic	Geography		Reading	Writing			Reading.		Writing	Model Drawing	
IV*a*.				Arithmetic	Reading		Geography	Writing			Arithmetic		Writing	Freehand	
IV.*b* IV.*c*				Arithmetic	Geography		Reading	Writing			Arithmetic		Writing	Freehand	
III.*a* III.*b*				Arithmetic	Reading		Singing	Geography		Mental Arith.	Arithmetic		Writing	Freehand	
VII.				{(*a*)Mechanics (*b*) English}	English		11 to 11.45. Arithmetic	11.45 to 12.	TUESDAY - -	Rapid Addition	Geom. Drawing		Writing	3.40 to 4.5. Geography or	4.5 to 4.30. Gen. Inf.
VI.*a*				French	Writing		Free. Drawing			Rapid Addition	Recitation		English	3.40 to 4.15. Writ. or Music	Writing down Homework 3.15 to 4.30.
VI.*b*				Arithmetic	Writing		Free. Drawing			Rapid Addition	Recitation		English	Writ. or Music	
V.*a*				Arithmetic	Reading		Writing	Criticism Less.		Rapid Addition	Arithmetic		English	Writ. or Music	
V.*b*				Arithmetic	Reading		Writing	Criticism Less.		Rapid Addition	Arithmetic		English	Writ. or Music	
IV.*a*				Arithmetic	Reading		Writing			Rap. Add. or Tab.	Ruler Drawing		English	3.40 to 3.55. Recit. / 3.40 to 3.55. Music	
IV.*b* IV.*c*				Arithmetic	Writing		Reading			Rap. Add. or Tab.	Ruler Drawing		English	Recit. / Music	
III.*a* III.*b*				Arithmetic	Reading		Ruler Drawing			Rap. Add. or Tab.	Elem. Science		Varied Occ.	Writing	
VII.				Arithmetic	French		Reading	English	WEDNESDAY -	Mental Arith.	Freehand		Phys. Exercise	3.40 to 4.5. Geography	4.5 to 4.30. Recit.
VI.*a*				Arithmetic	Geography		Writing	French		Mental Arith.	Mechanics		English	3.40 to 4.15. Geom. Drawing	Write down Homework 4.15 to 4.30.
VI *b*				Arithmetic	Geography		Writing	Reading		Mental Arith.	Arithmetic		English	Geom. Drawing	
V.*a*				Mechanics	Writing		Geography	Physical Exer.		Mental Arith.	Reading		Eng. or Gen. Inf.	Geom. Drawing	
V.*b*				Arithmetic	Writing		Geography	Physical Exer.		Mental Arith.	Reading		Eng. or Gen. Inf.	Geom. Drawing	
IV.*a*				Arithmetic	Reading		Writing	Geography		Mental Arith.	Free. Drawing		Eng. or Gen. Inf.	English	
IV.*b* IV.*c*				Arithmetic	Geography		Writing	Reading		Mental Arith.	Free. Drawing		Eng. or Gen. Inf.	English	
III.*a* III.*b*				Elem. Science	Reading		Geography	Recitation		Mental Arith.	Arithmetic		Writing	Free. Drawing	
VII.				Arithmetic	Reading		French	English	THURSDAY - -	Rapid Addition	Mod. or Fre. Draw		Writing	3.40 to 4. Geography	4 to 4.30. Music
VI.*a*				Arithmetic	Reading		Mechanics	Geography		Rapid Addition	Mod. or Fre. Draw		Phys. Exercise	General Infor.	Music
VI.*b*				Arithmetic	Reading		Writing	Geography		Rapid Addition	Mod. or Fre Draw		Phys. Exercise	General Infor.	Music
V.*a*				Arithmetic	Geography		Recitation	Reading		Rapid Ad 'ition	Arithmetic		English	3.40 to 4.15. Free. Drawing	Writing down Homework 4.15 to 4.30.
V.*b*				Arithmetic	Geography		Recitation	Reading		Rapid Addition	Arithmetic		English	Free. Drawing	
IV.*a*				Arithmetic	Reading		Geography	Writing		Rap. Add. or Tab.	Phys. Exercises		English	Ruler Drawing	
IV.*b* IV.*c*				Arithmetic	Geography		Drawing	Writing		Rap. Add. or Tab.	Phys. Exercises		English	Ruler Drawing	
III.*a* III.*b*				Arithmetic	Reading		Geography	Singing		Rap. Add. or Tab.	Reading		Elem. Science	Writing	
VII.				French	Reading		{(*a*)Mechanics (*b*) English}	{(*a* Mechanics (*b*) English}	FRIDAY - -	Mental Arith.	Arithmetic		Writing	3.40 to 4.15. Map Drawing	Writing down Homework.
VI.*a*				Arithmetic	Geography		French	Reading		Mental Arith	Arithmetic		Writing	Map Drawing	
VI.*b*				Arithmetic	Geography		Writing	Reading		Mental Arith.	Arithmetic		Writing	Map Drawing	
V.*a*				Geography	Free. or Model Dr.		Mechanics	Writing		Mental Arith.	Copy Books		Music	Map Drawing	
V.*b*				Geography	Free or Model Dr		Writing	Writing		Mental Arith.	Copy Books		Music	Map Drawing	
IV.*a*				Arithmetic	Reading		Geography	Copy Books		Mental Arith.	Recitation		Map Drawing	Music	
IV.*b* IV*c*.				Arithmetic	Geography		Reading	Copy Books		Mental Arith.	Recitation		Map Drawing	Music	
III.*a* III.*b*				Arithmetic	Reading		Geography	Copy Books		Mental Arith.	Phys. Exercises		Elem. Science	Writing	

Fly-leaf (1) to Form 122.
S.

TIME TABLE OF ORGANISED SCIENCE SCHOOL.

SESSION 1898–1899.

NAME OF SCHOOL—ANGEL ROAD BOARD (MIXED) SCHOOL, No. 9141.

COURSE—ADVANCED, FIRST YEAR. PROBABLE NUMBER OF STUDENTS IN CLASS, 16.

MONDAY	Manual Instruction 9—12					Theoretical Chemistry, 1 hour, 2—3		Practical Chemistry, 1½ hours, 3—4.30	
TUESDAY	Scripture 9—9.30	Euclid 9.30—10	Shorthand 10—10.30	English 10.30—11.15	Book-keeping 11.15—12	Geometry 2—2.45	Geog'phy 2.45—3.15	Euclid 3.15—3.45	English 3.45—4.30
WEDNESDAY	Scripture 9—9.30	Drawing 9.30—10.15	French 10.15—11	Shorthand 11—11.30	Algebra 11.30—12	Theoretical Physics 2—3		Practical Physics 3—4.30	
THURSDAY	Scripture 9—9.30	Algebra 9.30—10	History 10—10.30	French 10.30—11	Theo. Phys. 11—12	Geometry 2—2.45	English 2.45—3.30	Geography 3.30—4	French 4—4.30
FRIDAY	Scripture 9—9.30	Drawing 9.30—10.15	French 10.15—10.45	Euclid 10.45—11.15	Shortd. 11.15—11.45 Play 11.45—12	Theoretical Chemistry 2—3		Arithmetic 3—3.45	Trigonometry 3.45—4.30

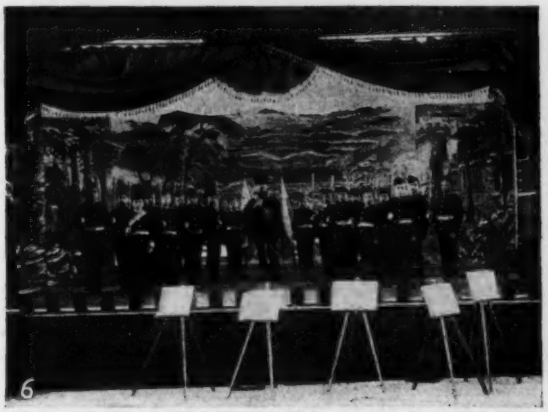
COURSE—ELEMENTARY, SECOND YEAR. PROBABLE NUMBER OF STUDENTS, 20.

MONDAY	Manual Instruction 9—12					Geometry 2—2.45	Geog'phy 2.45—3.15	Euclid 3.15—3.45	English 3.45—4.30
TUESDAY	Scripture 9—9.30	Shorthand 9.30—10	Euclid 10—10.30	English 10.30—11.15	Book-keeping 11.15—12	Theoretical Chemistry 2—3		Practical Chemistry 3—4.30	
WEDNESDAY	Scripture 9—9.30	Drawing 9.30—10.15	Shorthand 10.15—11	French 11—11.30	Euclid 11.30—12	Geometry 2—2.45	English 2.45—3.30	Algebra 3.30—4	History 4—4.30
THURSDAY	Scripture 9—9.30	Theoretical Chemistry 9.30—10.30	Shorthand 10.30—11	Algebra 11—11.30	French 11.30—12	Theoretical Physics 2—3		Practical Physics 3—4 30	
FRIDAY	Scripture 9—9.30	Drawing 9.30—10.15	Theoretical Physics 10.15—11.15		French 11.15—11.45 Play ½ hour	French 2—2.30	Geography 2.30—3	Arithmetic 3—3.45	Trigonometry 3.45—4.30

PROBABLE NUMBER OF STUDENTS, 40.

MONDAY	Euclid 9—9.30	Theoretical Physics 9.30—10.30		Practical Physics 10.30—12		French 2—2.45	Shorthand 2.45—3.15	Geog'phy 3.15—3.45	English 3.45—4.30
TUESDAY	Scripture 9—9.30	Theoretical Chemistry 9.30—10.30		Practical Chemistry 9.30—12		Algebra 2—2.30	Arithmetic 2.30—3.10	English 3.10—3.50	French 3.50—4.30
WEDNESDAY	Euclid 9—9.30	Drawing 9.30—10.15	Theoretical Chemistry 10.15—11.15		French 11.15—12	Geography 2—2.30	English 2.30—3.15	French 3.15—4	Euclid 4—4.30
THURSDAY	Scripture 9—9.30	Geometry 9.30—10.15	Book-keeping 10.15—10.45	Shorthand 10.45—11.15	Drawing 11.15—12	Arithmetic 2—3	Algebra 3—3.30	Shorthand 3.30—4	History 4—4.30
FRIDAY	Scripture 9—9.30	Geometry 9.30—10.15	Shorthand 10.15—10.45	Algebra 10.45—11.15	Arith. 11.15—11.45 Play 11.45—12	Theoretical Physics 2—3	Book-keeping 3—3.30	English 3.30—4.30	

THE ANGEL ROAD SCHOOLS, NORWICH.



1. Angel Road Schools, Norwich.
2. Dumb Bell Exercise in Central Hall.
3. Mr. Benjamin H. Barber.
4. Chemical Laboratory.
5. Winning Team in Shield Competition.
6. School Stage and Soldiers and Chorus.

which is used for throwing photographic slides on the screen, and in combination with one of Leache's lantern microscopes is used for throwing ordinary microscopic sections, is, in fact, a perfect boon to the teachers throughout the school.

On noticing how satisfactorily everything seems to work, we at once turn to Mr. Barber and say: 'But surely this is not a new school in every respect?' 'No,' he replies, 'it is practically an old school transferred to new buildings. St. Augustine's Senior Boys' School, about a quarter of a mile away, was opened by Mr. Tench, now H.M.I., in 1874. Mr. Tench was followed by Mr. Bidgood, now headmaster at Gateshead Higher Grade School, in 1883, and in 1889 I took charge. In 1895 the upper part of the school had increased to such an extent that it was found necessary to remove to new buildings, hence you find us here.' 'How do you find the Department's new system for science to work?' we ask. 'Exceedingly well,' is the reply. 'There are now no evening examinations—a great difficulty to young students—and we greatly appreciate the change from the old curriculum for Organised Science Schools to the present one. It is more practical. There is more scope for individual treatment of a subject under the new system. You see science is nothing unless it is practical. In our lower school we endeavour to carry out this idea to the fullest possible extent. It is mainly due to the fact that all our science work has been made as practical as possible that our success has been what it has. We have a splendid supply of apparatus.' Mr. Barber feels that the class of education given is one which, as a rule, gives a boy a good start in life. It is of so diverse a nature as to provide ground-work for boys to become skilled mechanics and business men, clerks, teachers, chemists, draughtsmen, etc. Several of the 'old boys' have become chemists, men-clerks in the civil service, or are acting as successful class teachers.

As he further remarked: 'Varied subjects will cause the boys when they leave school to turn into a great number of the side walks of industrial life. With greater diversity of subjects, more trades have appeared to be possible and congenial. It also has the effect of correcting the formerly too bookish training. Our four years' course provides a splendid all-round education—science, art, literary, commercial, and manual.'

The boys are always encouraged to do 'home work,' independent of school atmosphere and the presence of teachers. It helps to secure the personal interest of the parents, keeps the boys from the evil influence of the streets, and is a large foundation for self-reliance and self-culture after leaving school.

The parents, being mostly small shopkeepers and artizans, are very much interested in the school. This is shown by their attendance at the various exhibitions, entertainments, etc. They are at any time made welcome should they wish to come into the school.

It is hoped that in future a larger number of boys will be able to take advantage of the full course of instruction in the O.S.S. by means of scholarships which have just been made tenable at this and other secondary schools in the city. At the present time 27 boys in the O.S. School here hold scholarships to the value of £25 to £30 spread over three years. Apprenticeship premiums of £10 to £15 are annually competed for by boys leaving this and other schools, and nearly £900 has been won by St. Augustine's and Angel Road boys. These premiums, from two charity trusts, prove a great boon to many who become pupil teachers, etc., as the money may be spent in books, etc.

On going downstairs into the central hall we noticed that it contained some good gymnastic apparatus, and were informed that the *Physical Training* was one of the special features of Angel Road School. The school has a good *Football Club*, and, after twice being in the final for the Norwich and District Schools' Shield, were this year and last year successful in carrying off the trophy and medals. The second team has on one occasion reached the final for the Terrell Schools' Shield. The interest taken by the boys in the Football Club is very great, and there is the keenest rivalry among the boys to reach the standard of perfection, which merits promotion to the first team. This honest rivalry is introduced into everything connected with the school work, play, and attendance.

The splendid playground, nearly 90 yards long, is used for practice. In wet weather, American *Basket Ball* is often played in the central hall. It is a jolly game, and matches are arranged between the various classes.

Skipping-rope, atalanta, and flag races are arranged, Alexander's 'Book of Games and Sports' being found helpful in describing some of these.

A regular course of *Physical Exercises* is adopted, first without apparatus, then with wands, followed by dumb-bell and Indian club exercises. Parallel bar, horizontal bar, and vaulting horse exercises are also adopted with the older boys.

Provision is also made by the Board for a certain number of boys to learn *swimming*, and on two occasions boys from this school have carried off the shield and medal awarded to the boy who proves himself the fastest swimmer among the elementary school boys taught during the year.

We now passed through the various class rooms ranged round the central hall, and were exceedingly pleased at the enthusiastic way in which the work of each class was progressing. Each was in charge of a competent teacher, and Mr. Barber said he was proud of his staff, thirteen of whom are certificated. They are loyal and enthusiastic in the extreme, absorbed not only in the every-day work of the school, but taking a personal interest in their old scholars.

The work of the year is divided into three terms, each subdivided into two. These are regularly planned and worked, and an examination held each half-term. Certain subjects are taken by specially qualified teachers. For instance, in singing certain classes are massed together, and the subject is chiefly in charge of the several musical enthusiasts of the staff.

As Mr. Barber pointed out, such schools as this are at a great advantage in providing entertainments. The Christmas entertainments at Angel Road are already noted. The school possesses its own stage scenery and other effects. The following is the report of one of the entertainments as given in a local newspaper:—

> 'The large central hall of the school was filled to overflowing with an enthusiastic audience, the occasion being celebrated by the performance of a cantata, subject, "Bold Robin Hood and the Babes." This was undertaken by the scholars and teachers, and was almost perfectly performed The singing was charming, the acting all that could be desired At times the stage spectacle was most brilliant, and taking the entertainment as a whole it far surpassed anything of the kind previously given in the city. The children acquitted themselves so well that that in itself should be sufficient reward to the large staff of teachers who have interested themselves in this matter, and especially to Mr. Dobson, who has worked untiringly in training the children in their respective musical parts, and to Mr. F. E. Smith, who, besides undertaking the onerous duties of scenic artist and stage manager, yet found time to represent the principal character of "Robin Hood." And if this praise is due to the teachers, what must be awarded the energetic little performers themselves? Throughout they evinced an intelligence and precision which children of larger growth on the amateur stage would do well to follow. The choruses of the village children, the fairies, and the bold robber band went with a decided swing. Of the two little people, Master David Gook and Miss Ida Trollope, who represented the historic babes, it is impossible to speak too highly. The girl's natural timidity was just necessary for the part, whilst the frank, bold assertiveness of Master Gook provoked roars of laughter, besides which his pretty, tuneful voice captivated all hearts. Into the spirit of his part of the "autocratic ruler of the green"—the bellman—Master Leonard Delves entered with more than usual vigour and humour, and but for a bad cold from which the lad was evidently suffering, would have made a perfect representation. As it was, it reflected the greatest credit at once to himself and his careful trainer. The two young ladies who danced so very prettily also deserve a word of commendation too. The cantata, which went through without a single hitch, lasted two hours, at the conclusion of which Mr. George White presented the prizes.'

The refining influences of music and love of the beautiful are brought to bear on the school life of the scholars as much as possible. The school contains some very good pictures. Botanical and Natural History Diagrams also help to cover part of the enormous wall space. Cases of stuffed birds and animals, Arnold's coloured pictures of British Birds, Colman's

cards of eggs, birds, flowers, butterflies, casts of ornaments, etc., are also met with in the various rooms.

Drawing is marked 'Excellent,' along with the rest of the schools in Norwich, and the boys in the upper part of the school have always been very successful in freehand, model, and geometry of the elementary stage. The school is well supplied with models, and a splendid set of locally-made geometrical models is all that could be desired. Clay modelling, brush work, and design are found very helpful to the drawing. All these subjects have proved very useful, and it is found that harmony of colour and love of art can only be properly taught by such means.

The 'Guild of Courtesy' is strong here. It enables the teacher to bring courtesy and kindness directly and periodically before the scholars, in addition to the spirit which is always being inculcated in the school.

Owing to the growth of the school, by the time this article reaches the readers of the PRACTICAL TEACHER, the mixed department will be made into a school for boys only, and the control of the infants' department will be entirely in the hands of a separate head teacher, the Norwich School Board having changed its policy of 'one head teacher for a block of schools' since the Angel Road Schools were erected.

In connection with the St. Augustine's and Angel Road Schools, a very flourishing Old Boys' Union has been formed, with Mr. Barber as president. The object of the union is to bring together the boys who formerly attended the schools, and thus to enable them to renew the friendships and associations of the past. This is done by means of entertainments, excursions, and other forms of social meetings

The managers are intensely interested in the work of the school. The chairman, Mr. John Clarke, is a superintendent of a very large Sunday school with which he has been associated for over fifty years. Mr. Clarke is the local secretary of the Sunday School Union, and is well known throughout the country for the interest he takes in the Sunday school movement.

In conclusion, it should be pointed out that Mr. Barber's interest in education is not confined to his own school only. For some years he has been on the committees of the Cambridge University Extension, the Teachers' Guild, the N.U.T., and is the Vice-President of local branch of the latter. He is also a member of the Association of Head Masters of Higher Grade and Schools of Science.

AN APOSTLE OF HERBART.

IN her lucid **'Introduction to Herbartian Principles,'*** Miss Catherine I. Dodd, Mistress of Method, Day Training Department, The Owen's College, Manchester, gives further convincing proof, if such indeed were needed, of the Herbartian faith that burns within her. This will in no degree surprise those who know Miss Dodd, whether personally or through her writings, for she has already proved herself to be no lukewarm or half-hearted disciple of the great German philosopher, and this, too, in many ways. In journeyings oft to Jena—the Mecca of the Herbartian cult—to the homes and haunts of Pestalozzi and Froebel and other pedagogic worthies, Miss Dodd has spared neither time nor energy, to say nothing of the money which these pilgrimages must have cost. Certainly it will be a good day for English schools and teachers when masters and mistresses of Method shall emulate Miss Dodd's evident resolve and strive to become in very truth masters and mistresses of that Method which they profess to teach to England's budding teachers.

To consecrate the whole of one's private time and holidays to the betterment of one's professional knowledge is worthy of the highest praise, and this represents but a tithe of what Miss Dodd has done to perfect herself as a trainer of teachers. Like the true apostle that she is, the Manchester Mistress of Method is not content unless she inspires those teachers whose happy lot it is to pass through her classes with some portion at least of her spirit: of her success in this direction, the book just issued bears testimony, in the shape of worked-out practical experiments of teaching, for which Miss Dodd is indebted to ten of her students, to whom, in graceful acknowledgment, the authoress dedicates her book. We hasten to express our agreement with Prof. Rein, who furnishes Miss Dodd with an introduction to her 'Introduction,' that 'the present work will undoubtedly render service to English teachers' in leading 'the thoughtful teacher through this intricate detail of instruction, and, above all, in showing him how mechanical methods can be avoided, and teaching take its true place in true education.' The book certainly, to again quote the Professor, 'introduces them to the problems of educational teaching, and supplies a potent stimulus to systematic thought on the best method of instruction, while it presents an independent estimate of the results attained by methodical work since the days of Comenius, Pestalozzi and Herbart.' In Germany it is conceded that the mantle of Herbart has fallen upon the worthy shoulders of Dr. Rein, hence these few words of appreciation must be regarded as going far to establish the claim of Miss Dodd's book to consideration at the hands of all thoughtful teachers, a view that receives increasing and, finally, overwhelming corroboration as we peruse the pages of Miss Dodd's excellent 'Introduction' to the doctrines of such an interesting personality as Herbart undoubtedly was. It is by no means necessary to subscribe to Herbart's psychology in order to admire and adopt his views as to the end of education, and as to the practice that must be resorted to in order to achieve this end. To develop the moral man is the chief duty of the teacher from the Herbartian standpoint, and it would be difficult to describe the calling of the teacher in more solemn and, withal, in more attractive words. This was the cry of Comenius and of Locke in the fifteen and sixteen hundreds, and of Spencer and Thring in these latter days. Thus we have heard with our ears, and our fathers have declared unto us that character, and not cram, should be the end and aim of true education. But have we realised it, or are we advancing towards its approximate realisation? After making due allowance for the 'human children, human teachers, and human managers under human conditions' that Miss Dodd rightly keeps in mind, sadly must it be confessed, that the millennium is not yet, and that 'our means of education are often faulty and ill-considered, and the results are naturally imperfect.' Hence the thoughtful teacher will accord a warm welcome to such books as the one now under consideration, which points out a way leading towards the realisation, at least in some measure, of this true aim. If, as Kant said, there is in the world nothing good but the 'good will,' how persistently should we marshal all our forces so as to bring them to bear upon the production of this 'good will.

It is sometimes thought that Herbart was a visionary whose counsels were the unrealisable ones of perfection. How false this view is may be gathered from a study of Miss Dodd's 'Introduction' to his principles. Indeed, if space permitted, the robustness and common sense of the Herbartian recommendations could be proved to demonstration. English teachers, for example, will delight in the following slashing onslaught on *espionage*, and will appreciate to the full the self-dependence that is aimed at in these common-sense practical words, which certainly have no smack of the visionary about them :—

> 'I hardly dare express my opinion openly about supervision. I will at least not state it strongly in detail, otherwise parents and teachers might seriously credit this book ("Science of Education") with a considerable power of doing harm. Perhaps it has been my misfortune to witness too many examples of the effect of strict supervision in public institutions, and perhaps, having due regard to safety of life and strength of limb, I am too much possessed with the idea that boys and youths must be allowed to run risks if they are to become men. Suffice it briefly to remember that punctilious and constant supervision is burdensome alike to the supervisor and to those he watches over, and is apt therefore to be associated on both sides with deceit, and thrown off at every opportunity—and also that the need of it grows with the degree in which it is used, and that at last every moment of its intermittence is fraught with danger.'

Thousands of similar passages might be quoted, all bearing testimony to the eminently practical nature of Herbart's views, which, be it remembered, came to him from the practice of education and not from the perusal of books. It is this trait in Herbart that commends him to the regard and affection of such eminent men and women as Professor Rein and Miss Dodd, to say nothing of hosts of others who, like Principal Adams and Inspector Rooper, have eloquently testified

* Swan Sonnenschein & Co., London.

concerning the excellence of Herbartianism, as has been set forth in the pages of the PRACTICAL TEACHER. Miss Dodd has caught this practical spirit, and is not content to accept opinions on hearsay without putting them to the test of practical experience. We have convincing evidence as to this in the

MISS C. I. DODD.

September number of the *National Review*, which, over the name of Miss Dodd, contains an article entitled 'A Study in School Children,' wherein are detailed the results of a unique experiment. To 105 primary school children, between the ages of ten and fourteen, both urban and rural, Miss Dodd put the following questions :—What is a policeman, a postman, a soldier, a king, a professor, a member of Parliament, a negro, a School Board? The object of this catechism was to discover what amount of meaning, accurate or otherwise, these words connotated in the minds of the children. Our readers will be prepared to learn that the replies elicited were often extraordinary and frequently most vague. We have no space for the tabulation of this latest justification of the Shakesperian diatribe against verbalism: 'Out, idle words, servants to shallow fools.' We merely refer to the article as showing what may be expected from Herbartians, who are nothing if not practical. We do not wonder that Miss Dodd should approvingly quote at the head of her article the saying of Pestalozzi that 'Neither books nor any product of human skill, but life itself, yields the basis for all education,' for this is an article of the Herbartian faith.

We have left ourselves little space to deal with the book *per se*, but as is the writer so is the book, and our readers will easily supply this deficiency if they follow our advice and at once become possessors, not only of Miss Dodd's 'Introduction to Herbartian Principles,' but also of 'The Science of Education,' as set out by Herbart, for no enterprising teacher will rest content in ignorance of what one of the greatest writers of modern times has to say on the theory and practice of his craft.

Herbart's aim is aptly summarised by Miss Dodd in the following words :—

> Herbart lays down definitely at the outset that the one *supreme* aim of education is the development of moral character. He deduces this aim clearly and sharply from his system of ethics, which is based upon this principle of Kant—
>
> 'There is nothing in the whole world, or indeed out of it, which can be taken without limitation as good, except the *good will*. Education must help to form this *good-will* in the child, and Herbart shows us how all the activities of the school are to be devoted to this end. His aim is to make moral ideas the ruling forces in the minds of his pupils. These ideas are to sway the pupil completely, to penetrate into his disposition, to give him a right grip of life, and to determine his actions.'

And now we must desist, but we hope that what has preceded has in some measure shown how worthy of the master is the apostle, and how well qualified the latter is for the propagation of the Educational Gospel *in partibus infidelium*.

OUR NEW COMMERCIAL SCHOOLS.

I.—DALSTON.

MENTION was made in our last number of the new movement in London whereby the Evening Continuation Schools have not only been freed, but have at the same time so extended as to include special centres for instruction in Science, Literature, Commercial subjects, and Gymnastics. It was certainly no very bold experiment to open the Continuation Schools *gratis* to all comers, while the quidnuncs shook their heads and prophesied unpleasant things. It was quite another thing, however, to provide free instruction in science, literature, and commercial subjects, and too much credit cannot be given to the Rev. Stewart Headlam and his committee for this bold stroke of wise policy, concerning the success of which there is naturally much curiosity, in which no doubt many of our readers share. To satisfy this natural thirst for information, a special visit was made to the Queen's Road Commercial School, Dalston, of which Mr. J. Flint, B.A. (Lond.), is the Principal, and to whom we are indebted for much courtesy and kindness in giving us such ample opportunity of seeing what was to be seen. Guided by our host, we saw each class at work, and were able to note the demeanour of the students and the procedure of the teachers. It was a very interesting visit, and we came away convinced that at last something real was being done for the commercial education of the London cit.

The first room that we visited was devoted to typewriting. Twenty students were busy learning to manipulate the Barlock and Remington machines under the guidance of Mr. A. Wilkins, each set of twenty students having half an hour's practice twice each week. Already it was evident that progress had been made, although only a few lessons had been given. In addition to the typewriting, students are initiated into the mechanism of their machines, so that they handle them with due care. In this section of the school preference is wisely given to those students who possess a knowledge of shorthand. Here, as elsewhere in the school, men and women work cheek by jowl, and the minimum age is fifteen years. In the Commercial Geography Class we found about half a score students listening to Mr. A. W. Andrews, M.A., F.R.G.S., who was giving them a course of physical geography by way of prelude to the study of products, routes, tariffs, etc., which is to follow. Each student was provided with a specially-prepared map and a note-book, and special pains were evidently being taken to make the lesson real and interesting. And here we may remark that the London School Board is willing to provide text-books for the various subjects on loan if the students deposit the cost, which deposit will be returned when the book is returned in reasonable condition. Notwithstanding this most of the pupils prefer to bring their own books, a course which Mr. Flint naturally encourages.

Shorthand is, as might be expected, a popular subject. Some fifty or sixty students were receiving 'tips' as to the way in which outlines could be wisely shortened. The teachers of this subject are Messrs. Jackson and Wray, and it requires little knowlege of stenography to recognise that the Board has been fortunate in its choice of teachers in respect to shorthand. In the more elementary class the phonographic signs had just been mastered.

We were greatly pleased with the German lesson given by Dr. Emil Ebert, M.A., who was treating his twenty or thirty students to a masterly lesson on conversational lines. 'Was ist der Unterschied zwischen, Aúgust und Augúst?' were the words that fell upon our ears as we entered the room; and Herr Ebert worked away, talking in German and explaining what he had said in English, and then requiring its repetition in German from the students, giving such a lesson in German pronunciation as took us back to our days of drudgery and hard work on German Grammar and made our mouths fairly water. The subject of the lesson was the months of the year, and if Dr. Ebert teaches every part of his course as well as he was teaching the part to which we listened, we prophesy for him no small measure of success.

QUEEN'S ROAD, DALSTON, EVENING COMMERCIAL SCHOOL.

TIME TABLE.

Hour.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
7 till 8.20	Elementary Book-keeping Advanced Book-keeping Elementary Commercial Arithmetic Commercial English Elementary French Advanced French Elementary German Elementary Shorthand Advanced Shorthand Latin Typewriting	Elementary Book-keeping Elementary Shorthand Elementary French Intermediate German Advanced French Typewriting Script Shorthand	Advanced Book-keeping Elementary Arithmetic Elementary French Advanced French Commercial English Elementary German Intermediate Shorthand Advanced Shorthand Algebra Latin Commercial History (Lecture) Typewriting	Advanced Book-keeping Elementary Shorthand Reporting Shorthand Commercial English Elementary French Typewriting	Elementary Book-keeping Elementary French Advanced French English (Language and Literature) Elementary German Elementary Commercial Arithmetic Algebra Intermediate Shorthand Reporting Shorthand Political Economy (Lecture) Typewriting
8.20 till 9.30	Business Training Elementary French Advanced French Intermediate German Elementary Book-keeping Advanced Book-keeping Advanced Commercial Arithmetic Algebra Intermediate Shorthand Advanced Shorthand Latin Citizenship (Lecture) Typewriting	Elementary Book-keeping Elementary Shorthand Intermediate Shorthand Elementary French Advanced French Elementary German Typewriting Script Shorthand	Advanced Book-keeping Business Training Elementary French Advanced French Intermediate German Elementary Commercial Arithmetic Elementary Shorthand Reporting Shorthand Latin Commercial Geography (Lecture) Typewriting	Advanced Book-keeping Elementary Shorthand Advanced Shorthand Précis Writing Elementary French Typewriting	English (Language and Literature) Advanced French Elementary French Advanced German Elementary Book-keeping Advanced Commercial Arithmetic Elementary Shorthand Reporting Shorthand Commercial Geography (Class) Typewriting

The French Classes were conducted on similar lines by Mons. Bourich, B.-ès-Sc., and Messrs. Asbury, B.A., and Lee, B.A., it being evident that first the language and then the grammar is to be the order of instruction. Here also every effort was being made to encourage colloquial work, one student being told to ask for 'du papier,' and being answered 'avec plaisir,' just as we entered the class-room. In the Advanced Class, Ragon's French Commercial Correspondence was being used, and already a start had been made in the study of idioms, especially such as have a commercial value.

We were curious to learn what was to be taught under the head of 'business,' and we found Mr. Morgan hard at work initiating his students into the mysteries of commercial letter-writing. Later on in the session it is intended, said Mr. Flint, to go through the whole of the procedure of a first-class office in every detail, so that a student who goes through Mr. Morgan's course of lessons will understand everything that has to be done in carrying on the business of a large commercial house. The importance of this branch of the tuition cannot be over-estimated, and it is good to note that both Mr. Flint and Mr. Morgan are not only competent to teach, but are intent upon thoroughly teaching, everything that can be usefully included under this head.

In the Advanced Book-keeping Class we found some sixty students intently following the teaching of Mr. Coward-Tate, A.I.S., who had not only text-books, but also actual business books with which to show the students how the thing is done in a good business house; and again it struck us that the London School Board was fortunate in its choice of teachers, for if the zeal of Mr. Tate's class does but equal that of the teacher, a good, sound knowledge of the art of keeping books will be the boon bestowed upon them by this latest educational movement of the Educational Parliament of England's metropolis.

The Latin Class struck us as somewhat out of place. The atmosphere was rather that of an Oxford College than of the Dalston Commercial School. Miss Hughes, the teacher, was absent through indisposition, and her *locum tenens*—an Oxford man, we believe—was explaining to his small class how much it accords with the fitness of things to call the great Roman orator not Cicero, but Kikero. We listen unconvinced, and mentally we ejaculate, 'Que diable allait-il faire dans cette galère!' for we could not, nor can we, connect the Italian pronunciation of Latin with commercial education.

We did not see all the classes at work, as will be understood from a perusal of the time-table which accompanies this sketch, but we saw enough, and more than enough, to convince us of the wisdom of the movement, and of the judgment that has been shown in the selection of men to whom its development has been entrusted.

Mr. Flint, the principal, is all enthusiasm. He has already won his spurs in connection with educational movements, having been clerk and accountant to the London Society for the Extension of University Teaching for six years, secretary of the Finsbury Park University Extension Centre for three years, local secretary of the London Society for the Extension of University Teaching's Central Courses at Gresham College for six years, and secretary of the Gresham College Students' Association for three years. He was educated at St. James', Clerkenwell, and afterwards attended classes at the Birkbeck Institution, the Metropolitan School of Shorthand, and the Regent Street Polytechnic. In 1895 he graduated in Arts at London University. For the past five years he has taught commercial subjects—namely, French, Bookkeeping, and Shorthand—in the Evening Continuation Schools of the

MR. J. FLINT, B.A.

London School Board. The future of the Dalston Commercial School is thus in experienced and competent hands, so that a prosperous career may be hoped for and expected if only commercial men will encourage their *employés* to take

advantage of the opportunities afforded them for bettering their knowledge of their craft. At the time of our visit the number of students enrolled amounted to upwards of five hundred, and the cry was 'still they come.' This is a very satisfactory and even gratifying commencement, but the movement must be maintained, hence the need for encouragement on the part of business men, who will ultimately reap most benefit from the new departure. We note with pleasure that the members of the London Chamber of Commerce, for whose examinations Mr. Flint is preparing his most promising pupils, will give a preference to such pupils of those Evening Commercial Schools as succeed in passing the prescribed examinations. As we write, we have before us both the Consular Report and the German prospectus of the first Commercial High School in Germany that has lately been established at Leipzig, and which is attended by seventy-five Germans and twenty foreigners, amongst whom, plaintively adds the consul, there is to be found not a single Englishman. Students passing through this course will receive a degree diploma, so that Germany has again gone one better than any other state in exalting commercial training to the dignity of a Faculty. As the Consul rightly remarks: 'This new Commercial School is an instance of German foresight in grasping future necessities, and in providing betimes the means of supplying them. Its effect will be to bring German education in commercial matters, which is already high, to a higher level than ever before, and enable the German people to carry out commercial enterprises in the future even more successfully than they have done in the past. In the consolidation of the Empire as a powerful, industrial, and commercial state, this high school is bound to play a prominent part, and will no doubt, in the course of years, develop to dimensions not dreamt of now.' It is for Mr. Flint and his colleagues to emulate this example by the development of this most important and new departure as shall give this country a reason for the establishment of a Faculty of Commerce at some British University. That they will do their best according to their opportunities we are assured from what we saw, and we heartily wish them a successful accomplishment beyond their dreams.

HOW TO OBTAIN AN OXFORD DEGREE.

BY A PRACTICAL TEACHER.

THE interesting article entitled 'How to obtain the Cambridge Degree,' which appeared in the September number of the PRACTICAL TEACHER, suggested to the writer of the following brief sketch, that his fellow elementary teachers would like to learn in return, what facilities the sister University of Oxford offered to them in the way of obtaining a degree. I suppose there are few of us, who, in our P.T. days—rife with sanguine hopes of brilliant careers—have not mentally registered a vow that at the earliest possible opportunity we would acquire the privilege of attaching to our names those mystic symbols of B.A., or B.Sc. which mean so much. When talking of degrees, our thoughts most naturally turn to London University, since there is such a prevalent opinion that the older Universities in England are practically closed to persons not possessing considerable means; but I trust that the reader, when he has digested this article, will leave it with the opinion that the Oxford degree is by no means so exclusive as he may have imagined. As to the relative values of the degrees conferred by the British Universities, it would be unwise, and moreover absurd to discriminate; every Oxford man very naturally places on a higher plane the fortunate individual who has 'been up to' the classic city on the Isis, just as much as probably the graduate of—say, Timbuctoo—would regard his 'Varsity as the one 'par excellence' of the universe.

But, to get to our subject. Residence for twelve terms is a *sine quâ non*, and on no account is any departure made from this regulation. The academical year consists of four terms, so that we must regard the degree course as extending over three years. The terms are styled as follows:—Michaelmas, beginning about the middle of October and ending towards the close of December; this is followed by the Hilary term, broadly speaking, February and March; while the Easter and Trinity terms (commonly known as the 'Summer term,' and counting for two terms without a break in 'residence') commence in April and end towards the latter part of June. Each working term occupies about eight weeks, and during those weeks every undergraduate must *sleep* in Oxford for at least forty-two nights, but even this number may vary, according to the term. Naturally the interested reader, who is ambitious to secure an Oxford degree, is discouraged by this 'residence' stipulation, but to those of you who are keen and determined to try every possible expedient in order to acquire the coveted end, I will say at once 'don't be discouraged!' for it is by no means impossible to overcome this difficulty. To the writer's own knowledge there are a score or more of elementary teachers, trained at Battersea, Borough Road, York, Culham, etc., who are, or have been undergoing the degree course here.

Let me therefore place before the readers of the PRACTICAL TEACHER the 'open doors' to this degree which are available to them.

Firstly, the difficulty as to £. s. d. blocks the way in the majority of cases, and to calculate reasonably and justly, a man's expenses (*while residing in Oxford, i.e.* twenty-four weeks per annum) would amount to certainly not less than £60; this includes examination fees, terminal fees, tuition, board and lodging in houses specially licensed by the University. Beyond the above-mentioned amount, a man should have an extra supply of cash to cover expenses incurred in recreative pursuits (debating clubs, boating, cricket, etc.,) for the Oxford undergraduate fully believes in a *mens sana in corpore sano;* yet with economy and by living quietly as a 'reading man,' £60 should suffice for University expenses proper. The most economical mode of procedure is to join the Non-Collegiate body, and any information will gladly be given to anyone desirous of going through the University, if a letter of enquiry be addressed to The Censor, Non-Collegiate Delegacy, High Street, Oxford, To attach one's self to a *College* is a much more expensive proceeding, since not only are there additional collegiate fees, but the social element is far more *en evidence* here, and that necessarily entails expense—to estimate fairly, a College career costs at least £110 per annum, and this has reference to the smaller colleges alone; those of Christchurch, Magdalen, New, Balliol, are much more expensive and exclusive. To the elementary teacher there are three ways open for overcoming these obstacles of expense and residence. The writer knows from personal experience cases of men who have left Training College and then gone to work in Elementary Schools for some five or six years, meanwhile saving sufficient capital to justify their coming to Oxford and entering as undergradutes. If a man has any source whence he can augment his all too scanty savings, happy indeed is he! In fact it is by no means uncommon to hear of men 'borrowing' enough money to enable them to come up, so eager are persons for the Oxford degree.

This next method is perhaps more suited for the pocket, but certainly less desirable from a physical point of view. It is possible to get a post as an Assistant Master (or even 'Head') in one of the Oxford Elementary Schools. By scanning the advertisement sheets of the 'Schoolmaster,' one can await and attack an opportunity, and indeed such an opportunity is closely watched. Even then it is generally essential to have some little Klondyke of one's own, to 'defray extra expenses' which continually arise.

There yet remains one other method, but this must have sole reference to the intending Scholarship student. There is a Day Training College at the University, and the opportunity is offered to First-Class Queen's Scholars of performing what the old proverb states is impossible—to do two things at once, *i.e.* gain both certificate and degree. Some two or three of the Oxford Colleges are at length looking with kindly eyes upon the struggling aspirants for Honours, and have offered Exhibitions to Scholarship students, thus enabling them to secure the much coveted 'College' career. A man who can add such an exhibition to his Government allowance, with perhaps a 'Toynbee' scholarship as well, should be very comfortably situated from a financial point of view.

But to come to the next, and perhaps most important item—the course of studies. There are two ways of gaining a degree,

by taking a 'Pass' or an 'Honour' School. The former is achieved by the average man if he works well, in three years; but the student who 'reads for Honours,' needs *as a rule*, four years for his 'school,' the examinations being both difficult and extremely searching.

Let us imagine a man entering upon his residence in October next, for this is when the Academical year commences, and the most favourable term for matriculation. Here let us note that the Matriculation Examination at Oxford is not a public University test, but is conducted privately by the different colleges; if the future undergraduate be well advised, he will have taken 'Responsions' (in 'Varsity slang 'Smalls') which is the first University examination, in the previous September, and so he will be excused the Matriculation test. The subjects which have to be taken up are as follows:—*A Greek Author*, Xenophon, i—iv, *or* Euripides, 'Hecuba' and 'Alcestis' being the favourites. *A Latin Author, e.g.*, Cæsar, Gallic War, i—iv. *Latin and Greek Grammar;* this paper is decidedly catchy, and proves a rock of stumbling to many Teacher candidates. *Latin Prose*, a passage about the length of a Standard V. composition story is to be translated into Latin. *Arithmetic*, and either elementary *Algebra* or *Euclid*, Books i., ii. If successful in this, there now remains the introduction (together with perhaps some half-hundred others) to the Vice-Chancellor, and our future Oxford student having parted with sundry coins of the realm, dons his gown with 'leading strings,' places his 'square' on his head, and proudly emerges from the Divinity School with a ponderous volume of University Statutes under his arm; a gift from the 'Varsity, as a slight return for the fee just paid—now, indeed, a duly matriculated member of the University.

The next question our new undergraduate has to answer is, 'Shall I read for "Honours" or a "Pass?"' If the latter, he will probably take in the following June the Second Examination, known to the undergraduate as 'Mods.' but to the dignified Don as 'Moderations,' or 'First Public Examination.' This is in reality a more advanced edition of Responsions; that is, the character of the subjects is about the same, but different authors *must* be read. If successful in this and the 'Viva-Voce,' which is included, he will have to take for his 'Finals' three groups of subjects, the classical group comprising Aristotle's Ethics and Livy xxi—xxiii (the most favoured authors) being a compulsory one. For his two remaining groups he has the option of some twenty or more subjects, including English and Ancient History, Shakespere, Political Economy, Divinity and Science. Then he is, if successful, eligible for his degree. But to return to our 'Honours' man of more ambitious turn of mind, whom we left proudly standing on the farther bank, having successfully crossed the whirlpool of Responsions, wherein so many sink. He, with his tutor's advice, finally decides what Honour School he shall take. Practically, he has choice from the following—(1) Modern History, (2) English Literature, (3) Natural Science. We may regard the Classical and Mathematical School as being decidedly beyond an Elementary teacher, who probably lacks the continuous study of these subjects from early boyhood; the Theological School is naturally assumed by those who are ultimately seeking ordination. The History School is a very popular one, but it is by no means easy; the 'Firsts' are few and far between, and the men who gain this distinction are some of the most brilliant students of their year, for there is immense scope here both with respect to depth of thought and breadth of reading. The syllabus of work is far too lengthy to insert here, but to a man who is fond of History, this school would be undoubtedly the most suitable. The 'English Literature' School is of very recent establishment, in fact, only two class-lists have as yet been issued; and up to the present, men have regarded the subject with a certain amount of timidity; whether its popularity will increase we must wait for time to show.

There now remains 'Natural Science,' which year by year grows in favour, as the lists testify, and which in a few years will possibly rival 'Modern History' in popularity. The majority of the men seem to prefer Chemistry as their subject, and perhaps for the schoolmaster it would be the most suitable, since many have already dabbled in it in Training College. It will of course be realized, that a 'First Advanced' means the mere rudiments compared with the amount of knowledge needed for an 'Honours'' school. For an elementary teacher who can obtain a 'First' or 'Second' in this school, there seem at the present time to be great possibilities, and surely little doubt can exist that the sacrifices which he has made for a time will be more than recompensed by the position he can command at the end of his University career.

Time and space will scarce admit the treatment of 'Oxford Life,' the morning chapel and lectures, the boating or tennis, and social teas in the afternoons, ending with the calm, quiet evenings devoted to 'reading,' broken, perhaps, by the Debate at the 'Union' or other University social meetings. Yet, in conclusion, the writer is fain to add a word more. After all 'tis not the *class* which a man secures in his final exam. which stamps him *as a man:* 'tis something far more than that! And only he who has been fortunate enough to experience life at one of the older Universities, he who can look back with tender admiration upon Oxford or Cambridge, or a Scotch University, as his Alma Mater, can truly realize what that well-nigh indefinable world '*Culture*' means—which likewise to the ancient Greeks was the essence of education. To live in an atmosphere hallowed by the recollections of those great ones who have passed away, to sit at the feet of those great ones of the present and recognize indeed their greatness and one's own insignificance, to rub shoulders with undergraduate superiors and equals in the social scale, to lose that narrowing individuality which all too often cramps the schoolmaster, and feel what Aristotle ages since enunciated, '*φύσει πολιτικὸς ἄνθρωπος*' (man is meant by nature to be a social animal) this is indeed an education which can no where else be found. And seeing what Oxford has done in the past, and still is doing, and will continue to do, to realize the hopes of the men who come up, year after year, with yearning and ambitious aspirations both for the betterment of themselves and others, a loyal son of Oxford cannot more suitably conclude this article, than by quoting that grand old motto of his Alma Mater:—

'*Dominus Illuminatio Mea.*'

Opium and Morphine in China.—In China the foreign opium trade is decreasing every year. Native opium is taking its place, and the morphine habit is gaining ground among the Chinese; the import of morphine into Shanghai in 1897 was no less than 68,000 ozs.

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The Formation of Sorbose.—Bertrand has lately been investigating the formation of sorbose, a sugar first discovered by Pelouze in 1852. He thinks that sorbose does not exist as such in the juice of mountain ash berries, but is formed by oxidation from sorbite contained in the juice under the influence of a bacterium analogous to the *Bacterium xylinum* of Brown.

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Ants and their Secretions.—M. Janet in a recent number of the *Comptes rendus* gives the results of his investigations with regard to the secretions of ants. He exposed test papers in the chambers and galleries of ants' nests, expecting an acid reaction, but they gave indication of a marked alkalinity as long as the inmates were undisturbed. When, however, they were excited, the alkaline reaction was replaced by a marked acidity. In those species—the *Formicina*—which secrete the greatest amount of acid venom, this alkalinity was more intense. The tegumentary glands, especially those in the buccal region, furnish this alkaline secretion. Its function is supposed to be serving as an antidote to the acid venom, and to prevent auto-intoxication of the insects when large quantities of formic acid are discharged by them when defending their nests.

☞ Teachers have now the great privilege of compiling schemes of Drawing and Manual Training to suit the need of their own schools. The 'Practical Teacher's Art Monthly' gives indispensable aid in this. November Number, now ready.

OUR SEARCH-LIGHT COLUMN OF CURRENT EVENTS.

THE most striking events of general interest which have occurred since the writing of our last notes on current news are those connected with affairs in China, and in Crete, the relations of England and France, and the remarkable developments in the Dreyfus Case.

Disturbances in China.

Since the establishment of Russian, German, and British posts at Port Arthur, Kiao Chau, and Wei-hai-wei, respectively, there have been from time to time reports of riot and revolt in different parts of China. It appears that the Emperor of China has been too decidedly favourable to rather sweeping reforms, and an influential party of the governing class, with the Empress Dowager at their head, have raised a strong opposition. The Empress Dowager was for several years Regent during the minority of the Emperor her nephew. She is a woman of great power of will, and has practically seized the reins of government. The Emperor has been forced to re-establish her regency, and to do homage to her. Some of his reforming advisers have been degraded and executed, and others have escaped from China. Rumours of the death of the Emperor have been contradicted; but there is reason to believe that his position differs little, if at all, from that of a prisoner of state. Recent reform edicts have been rescinded by the Empress Dowager. How this revolution at Peking may ultimately affect foreign relations is not easy to forecast. It is to be hoped that it may not prevent the peaceful development of trade with civilised nations.

Settlement of the Cretan Question.

As a result of the serious revolt referred to last month, four of the European Powers, Great Britain, France, Austria, and Italy, presented a joint ultimatum to the Porte, or government of the Sultan, demanding, among other things, the complete withdrawal of all Turkish soldiers from the island. After some delay the Sultan accepted these terms, and the evacuation of Crete will soon be an accomplished fact. Its administration will then probably be carried on under the control of the Powers until a governor is definitely appointed. This will certainly be to the great advantage of all dwellers in the island.

England and France.

After the annihilation of the forces of the Khalifa at Omdurman, the Sirdar, Sir H. Kitchener, proceeded up the Nile to Fashoda. There he found Major Marchand and eight French officers, with 120 Soudanese troops. The Sirdar laid claim to the place in the name of the British and Egyptian Governments, and hoisted the flags in the neighbourhood. The matter has caused a great deal of rather blustering talk. Lord Salisbury has definitely declared that the British Government cannot recognise any French claim to Fashoda; and it seems probable that a way may be found to satisfy French *amour-propre*, and the natural desire for certain commercial facilities without endangering peace.

The Dreyfus Affair

is for France a very serious matter. Colonel Henry, late chief of the Intelligence Department of the French Army, after being arrested and confessing to the forgery of one of the letters incriminating Dreyfus, committed suicide in prison. The Minister of War, General Cavaignac, then resigned. His successor, General Zurlinden, after a few days' tenure of office, also resigned; and immediately resumed his former post of Governor of Paris. Other important officials have been cashiered, and after much consideration the French Government, with M. Brisson at its head, has consented, in spite of determined and bitter opposition from the army, to allow the case to be re-opened, and it has been decided that the matter shall be the subject of a public inquiry. Among the extraordinary features of the case are the facts that Colonel Picquart, who has been imprisoned for expressing his disbelief in the genuineness of a certain letter, is still refused release on bail, though the letter is now known to be a forgery; and that M. Zola, the novelist, has been condemned for openly championing the cause of Dreyfus as a man not fairly tried. It is difficult to understand how in a reasonable and civilised community Jew-hatred can blind so many to the claims of justice in dealing with accused persons.

To those who would supplement our necessarily brief comments on the month's news, we commend Mr. Stead's Summary of the Progress of the World in the *Review of Reviews*. That monthly leading article is no doubt considerably coloured by the writer's decided opinions, but it abounds in striking ideas vigorously and clearly expressed.

Death of the Queen of Denmark.

Last month we reported the terrible tragedy which closed the life of the Empress of Austria. Her body was removed from Geneva to Vienna, and there, on the 17th of September, buried with all the honours due to her rank and character. We have now to record the death of the aged Queen of Denmark who, after being for sometime in an ailing condition, passed peacefully away at the age of 81 surrounded by all the members of her family. Her simple and noble life had endeared her not only to her husband and children, but to her own people, and to many in other lands. Europe, indeed, is indebted to her; for the influence of her wise and loving training of her children must have been beneficial in the lands where their lot has been cast. She was the mother of our own dear Princess of Wales, of the Dowager Empress of Russia, and of the King of Greece. She was laid to rest in the Cathedral of Roskilde on the 17th of October.

The Kaiser's Tour.

For some weeks preparations have been going on for an impressive journey on the part of the German Emperor. With Jerusalem for his destination, he set out with the Empress and his suite on October 11th, and visited Vienna in his route. His yacht, the *Hohenzollern*, was delayed by stormy weather on the shores of Greece, but at the time of this writing he has reached Constantinople, and been received by the Sultan of Turkey. He was to have visited Egypt, but the arrangements were modified possibly for political reasons. It is reported that some anarchists intended to carry out a plan of assassination when the Kaiser visited Cairo, and on his route being changed, they tried to get from Alexandria by ship to carry out their intention in Syria. They were, however, under observation, and were captured with bombs in their possession.

Miscellaneous.

Amongst the events of the last weeks may be mentioned the capture by the French of Samory, the most powerful of the independent chiefs in the lands west of the Niger. For twenty years he has been a source of trouble in the hinterlands of the French settlements.

The Khedive of Egypt is reported to have shown signs of disaffection towards the British authorities, who have maintained him in his position, and a question has been raised of his deposition.

One of the most terrible of recent disasters is the total loss of the Atlantic Liner *Mohegan*, which, being for some unaccountable reason out of her course, struck on the Manacle Rocks, near the Lizard, on the evening of October 14th. Over one hundred lives were lost, and many of those who were saved suffered extreme hardships.

Personal Notes.

Two items of news may be recorded as having an educational interest; first, in memory of Professor John Hopkinson, whose death on the Alps was mentioned in last month's summary, a sum of £5,000 has been given to provide an additional wing to the Physical Laboratory at the University of Cambridge. Second, Mr. Corbett, formerly M.P. for Worcestershire, has offered £50,000 to found a school of Agriculture in that county.

On the 29th September, at the age of 69, died the Hon. T. F. Bayard, late United States Minister to this country.

Since then have died the Marquis of Anglesey, Mdme. Carnot, widow of M. Carnot, late President of the French Republic, and Lady Cromer, wife of Lord Cromer, who has displayed such ability in successfully re-organising the finances of Egypt.

Just as we are going to press we learn that Mr. Harold Frederic, a very able American novelist, has died from an affection of the heart at the early age of 42, and that Mr. Gleeson White, a prominent writer on art, has succumbed at the age of 47 to the after effects of typhoid contracted while on a visit to Italy.

Our Monthly Retrospect

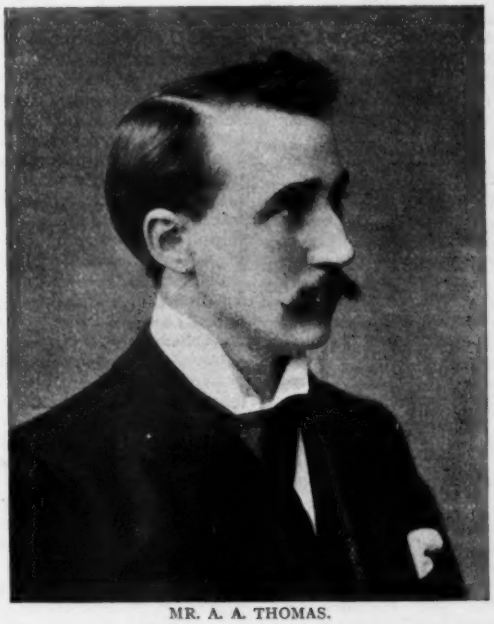
EDUCATION IN ENGLAND.

N.U.T. NOTES, &c.

BY T. B. ELLERY, F.R.G.S.,
1895-6 *President of the National Union of Teachers.*

The Conscience Clause Again. The Executive of the N.U.T. at its meeting, on October 8, had the Conscience Clause in Training Colleges again under consideration.

Immediately the question was reached a motion was carried 'that the question be now put.' It seemed to me, and I venture to think it will seem to a great many others, a very unwise proceeding, for a matter of such importance might well have received further consideration, notwithstanding the fact that it had been debated at some length at the previous meeting. However, majorities must rule, I admit, and therefore, the question was put, after Dr. Beach, the mover of the rescinding resolution had replied. The Doctor was in 'fine form,' making point after point, but it was a foregone conclusion. By 23 to 10, if I remember rightly, the friends of the Conscience Clause defeated the motion, and the Executive thus stands committed to a policy of the Conscience Clause in all Training Colleges. I still believe it to be altogether the wrong policy, for as I have already said in these columns, the true solution of the difficulty is the provision of additional Training Colleges. That could be secured with comparative ease if the Union set to work in earnest. The minority on Oct. 8 laboured under the disadvantage of the absence of Dr. Macnamara, Mr. Clancy, the Vice-President, and Mr. Blacker, all of whom were engaged elsewhere on other Union business.



MR. A. A. THOMAS.

Superannuation. We are now busily engaged in devising some sort of ancilliary scheme in connexion with the Superannuation Act of 1898. It is by no means an easy task, as my readers may well imagine. We have the advantage of the assistance of the well-known actuary, Mr. Andras, whose services on the Superannuation question some years ago I well remember. Conferences between representatives of the Executive and of the Provident Society have been held, the whole position has been very carefully discussed, and, as a result, Mr. Andras has been instructed to prepare a scheme whereby the payment of an annual premium by a teacher will entitle that teacher, or his heirs or assigns to receive back a sum equivalent to the amount of money paid by him to the Annuity Fund under the Act in certain eventualities. These eventualities I need not enumerate now, as I shall return to the subject when the tables are in our possession.

In the meantime I gratefully acknowledge the receipt of letters of thanks from many readers of the PRACTICAL TEACHER, and of resolutions conveying congratulations from many Associations, including West Lambeth, Cockermouth, Sheffield, Watford, Hull, Brighton, Northwich, Bristol, Plymouth, Hartlepool, St. Albans, the Norfolk Confederation of Rural Teachers, Ashton.

In view of the 'criticisms (!)' of the Head Teachers' Association, these letters and resolutions are doubly welcome.

School Attendance. Miss Selvage, Mr. R. Wild, B.A., the Education Committee of the N.U.T. Executive, and Dr. Macnamara have rendered excellent service in disclosing a scandalous state of affairs in the matter of school attendance in Lincolnshire. The registers of one school show the following :—

1. Possible No. of attendances, 1,054. No. of attendances made, 304.
2. Possible No., 76. No. made, 159.
3. Possible No., 1,200. No. made, 596.
4. Possible No., 1,020. No. made, 632.
5. Possible No., 600. No. made, 220.
6. Possible No., 384. No. made, 25.

If this exposure is not sufficient to move the powers that be to take action in enforcing attendance, then nothing will move them.

The Executive, at its meeting on Oct. 8, passed a hearty vote of thanks to Miss Selvage, who first brought the matter of school attendance in Lincolnshire under the notice of the N.U.T., and to Mr. Wild, who conducted the enquiry subsequently made. Everyone will admit that the compliment was thoroughly deserved.

Conference on School Attendance. In connexion with this question of attendance at school it may be of interest to state that a Conference of representatives of the School Attendance Officers' National Association and of the N.U.T. was recently held at the School Board Offices, Birmingham, under the chairmanship of Mr. J. A. Palmer, Clerk of the Board. As all my readers may not have read the resolutions unanimously adopted, I venture to give them here :—

1. That in rural districts the areas supposed to be supervised by Attendance Officers for the purpose of securing regular attendance at school are generally much too large, and should be considerably less in extent.

2. That the joint associations represented be asked to consider the advisability of School Attendance Officers being placed under the direct control of the Education Department.

3. That special magistrates should be appointed to deal with school attendance cases.

4. That in the opinion of this Conference in cases of repeated summonses nothing less than the full fine of 5s. should be inflicted on conviction ; that both parents should be amenable ; and that doctors' certificates dated subsequently to the date of the offence should be refused by the court.

5. That this Conference recommends that the maximum penalty for each breach of the Education Acts and Bye-Laws be increased to £1.

6. That the employment of children in all forms should be placed under the Inspectors of Factories and Workshops.

7. That employers be required to produce a certificate of legal exemption from school for every child whom they employ.

8. That this Conference desires to express satisfaction at the action of the Education Department in getting statistics respecting little slave pupils, and trusts that speedy legislation will follow.

9. That in the opinion of this Conference all private elementary day schools should be registered; be subject to periodical inspection; and also that the Attendance Officer of the local authority should have access to the registers of attendance for the purpose of the compulsory clauses of the Education Acts.

10. That this Conference urges upon the Government the necessity for the immediate introduction of a Bill raising the age for partial exemption to 12 years, with the automatic increase to 13 years in three years time.

11. That age and attendance should be the only qualification for labour. That in ordinary circumstances the minimum age for the total exemption of children from attendance at school should be thirteen years; and as regards children between thirteen and fourteen, the only qualification for total exemption should be 350 attendances annually during five of the six years immediately preceding the application for such exemption.

The New President of the M.B.T.A. The members of the Metropolitan Board Teacher's Association have made an excellent choice in electing Mr. A. A. Thomas, B.A., as their President for the ensuing year. On a former occasion I gave in these columns some details of his work. It is unnecessary therefore to say much now. But I congratulate Mr. Thomas upon having reached the highest position in the M.B.T.A., and I congratulate the members upon their selection. The new President's work for his fellows, his enthusiasm, and his ability, all entitle him to the highest honours which the profession can bestow upon any one of its members. As Hon. Sec. of the N.U.T. Examinations Board he has rendered the Union signal service, which I do not think will be forgotten when a permanent official is necessary for that department.

The Tenure Problem. With Superannuation an accomplished fact, it is now more than ever incumbent upon the Executive of the N.U.T. to give its attention to the question of reasonable security of tenure for the teacher. It will be nothing short of monstrous if managers of voluntary schools or school boards are to have the same power in the future as they have had in the past of dismissing a teacher upon other than reasonable grounds. We do not seek to defend the immoral or the incompetent, but we do say that no man or woman should be dismissed upon pretexts which would not be accepted in a court of law. Take the case of a man some years hence who has paid his contributions regularly to the State Annuity Fund for say ten, twenty, or thirty years, and is then dismissed by his managers without just cause. Such a man will have, as teachers have to-day who are similarly dismissed, very great difficulty in obtaining another appointment, and it is quite possible that he will never succeed in obtaining one. Is that state of things to continue, when for all teachers who enter the profession after April 1, 1899, the payment of the annual premium to the State fund will be compulsory? Take the Linthwaite case, the particulars of which are probably well known to my readers. The dismissed master has replied in full to the charges made against him; it is evident the Board has no case; yet there is no court of appeal! Fortunately, however, there can be, by and by, an appeal to the ratepayers, and we are confident as to the result. In the meantime it is to be hoped that no teacher will accept the appointment. The Chairman and Vice-chairman of the Board have visited different places and offered the post to certain class-teachers, all of whom, I rejoice to say, have refused the offer.

What may happen before these lines are in the hands of my readers one cannot say, of course, but I trust the fine union spirit already shown will continue. If so, the members of the Linthwaite School Board will have had a lesson which they will not quickly forget. We have only to wait until next April, and then the ratepayers will have an opportunity of showing these good men that teachers, like other people, are entitled to fair play.

Death of Mrs. Addiscott. Every reader of this Journal will regret to hear of the death of Mrs. Addiscott, wife of the N.U.T. Ex-President. She has been ill for some time, and passed away on October 9th. The deepest sympathy with Mr. Addiscott is felt and expressed on all hands. May he have strength to bear this heavy bereavement.

The Cambridge Conference, 1899. It is, perhaps, a far cry to the next Conference, but in these days arrangements must be made well ahead, or there will be a hitch somewhere. Cambridge evidently recognises this, for university dons and townsmen are already joining heartily with the local teachers in settling all the details of the week's engagements. It looks at present as if the Conference will be made, in a fuller sense than ever before, an educational demonstration.

The ladies—some of them, at any rate—want a Session entirely devoted to their affairs. Whether this will be conceded I cannot yet say, but if so, it will be a precedent, and I am not at all sure that it will be a wise one. What will probably happen is this: all the questions especially affecting ladies will be grouped and dealt with early in the week, a good place being given to them on the agenda.

It is whispered that there is to be a dinner. Personally, I have no objection, but have the dinners been great successes in the past? If on this occasion the attendance of certain well-known educationists, whom I will not name now, can be secured, well and good.

I am glad to note that the 'members for East Anglia' on the N.U.T. Executive have been elected to serve on the General Conference Committee. It is a compliment which I am sure the three gentlemen concerned fully appreciate.

F. F. Wheeler. I was prevented by my inexorable editor from referring in my last 'Notes' to the interesting presentation to the genial 'F. F. Wheeler.' The fact is the said editor insists on placing a limit to my enthusiasm, with the result that I exceed a page with fear and trembling. However, let me in a few words say how delighted I was to find the Executive honouring that veteran in unionism, who is no longer with us at Russell Square. Every compliment paid him that day he well deserved, and I trust he and Mrs. Wheeler have before them many many years of happiness. The Cheltenham teachers have also made a presentation to him, partly on account of his recent Conference labours, but also, I am sure, because of his devotion to the cause he has had at heart for so long a period. That he will be missed at the Executive meetings goes without saying, but, after all, it is possible we may see him at Russell Square again. Who knows?

Specific Subjects Schedule. Many teachers have asked why schedules are still sent to schools where specific subjects are taken, seeing that Examination has given place to Inspection. I am able to say they are not required for the purposes of examination, and individual 'passes' and 'failures' will not be recorded upon them. The reasons for their use are—(1) to guarantee that only those boys and girls are presented who are qualified by the Code, and (2) to record the number of hours given to those particular subjects during the year. This is, of course, information which the Department must have in its hands before the amount of grant can be determined.

N.U.T. Examinations Board. This departure of the N.U.T. has been more successful than even the most sanguine amongst us ever anticipated. The increase in the number of candidates presented is most gratifying, and everywhere teachers are expressing their entire satisfaction. Managers, who held aloof at first, are beginning to see that the examinations provided by the Board must be of great service. Many of them, indeed, say so. Let those of my readers who have not yet received particulars of the scheme send to Russell Square without delay.

The Charitable Funds. What are the Associations doing in the matter of organising concerts, bazaars, &c., &c., in aid of the Benevolent and Orphan Funds? I trust that no time will be lost, *for the need is great.* Only those of us who are engaged in the administration of these funds know how great that need really is. Cannot every reader of the PRACTICAL TEACHER, and every member of the Union, guarantee to collect or give ten shillings? Surely that is not too much to ask. As the Cambridge Conference is to be a big educational demonstration, let us show the general public what we are prepared to do for those who are in a great measure dependent upon us.

EDUCATIONAL NOTES.

BY CATHERINE I. DODD,
Owens Day Training College, Manchester.

Sir Douglas Galton on The Care of Feeble-minded Children. Children's Likes and Dislikes. Study of a Child, by Louisa Hogan. Prof. Miall on Children's Curiosity.

THE simple and single remedy for the child who could not do his lessons was, in the good old-fashioned days, the birch rod. We are beginning to recognise now that children have different capacities, and they require to be treated according to their individual needs. Sir Douglas Galton, in his address at the opening meeting of the Manchester branch of the Child Study Association, clearly demonstrated the necessity of making a study of the needs of individual children.

In discussing the influence of evil environment upon children, he pointed out that if the special characteristics of each child were carefully noted, and its education carefully adapted to its wants, intemperance, vice, and crime would steadily diminish. If children were classified according to their intellectual development, education would be placed on a sounder basis. Excluding the blind and deaf, he classified children as follows :—

Firstly, the normal bright child.
Secondly, the dull backward child.
Thirdly, the mentally feeble child.
Fourthly, the lower grade of the feeble-minded, that passed into imbeciles and idiots.

The founders of 'Childhood Society' had for years been engaged in devising scientific methods which would enable school authorities to determine the mental capacity of each child with some degree of certainty, so that the mentally unfit might be distinguished from the indolent and inattentive. Physiologists and medical men, who had studied diseases of the mind, were well acquainted with the fact that the bodily actions and movements of mentally defective children made their condition apparent to the skilled observer. Sir Douglas Galton quoted from numerous authorities to show the great possibilities existing for bettering the condition of the imbeciles and idiots by careful and sympathetic training; and he surmised that the merely feeble-minded might, with the same sympathatic treatment, be raised to the status of normal children.

The larger proportion of feeble-minded children were incapable of receiving proper benefit from the ordinary elementary education in our primary schools, and beyond acquiring certain habits of discipline their time was wasted there; yet they showed themselves capable of receiving considerable benefit from special instruction and individual attention. They, often at the age of 13, showed themselves capable of arriving at the stage of elementary instruction usual to children of 8 or 9, and they were frequently successfully trained in manual occupations. It was as much benefit to the community to care for the feeble-minded as to care for people suffering from lunacy and infectious diseases. The lunatic is dangerous physically, but the feeble-minded, if untrained, becomes a source of moral degradation.

Sir Douglas Galton deprecated special institutions for the training of these children, and advocated home-life in connexion with special classes.

In conclusion, he said that if the expense of carefully training the feeble-minded was now heavy, it was owing to the short-comings of former generations and our own. 'We were reaping what our *laissez-faire* system had sown. The Victorian era had done much for physical sanitation. We were endeavouring on all sides to remove the sources of pollution which that system had allowed to injure our water supply, our air, and our soil. We ought now to take in hand, and endeavour to extirpate more vigorously than we had yet done, the moral pollution which caused the degradation of our children at their advent into life.'

The programme of the Manchester Child Study Association for the coming session includes papers by Mrs. Mumford on 'Problems of Infant Life,' on 'Truth and Make-believe,' by Miss Rhys, and 'Exceptional Children' by Dr. Shuttleworth.

Information is being collected on 'Children's Likes and Dislikes,' and the following form is issued to members :—

Child's name ——. Age ——.
1. What animals are preferred or disliked?
2. What colours are preferred and distinguished at this age?
3. Is the child afraid of the dark? Has it always been so? Have others taught it to fear the dark?
4. What toys are liked best? What things are most avoided when seen?
5. What kind of things does the child most like doing of itself, or when told? What kind of things does it most dislike doing?

I shall be glad to receive accurate answers to these questions from teachers and parents.

Harper's Monthly Magazine, June, 1898, contains an interesting 'Study of a Child,' by Louisa Hogan. She says :—

> 'The child was trained under what might be called the Pestalozzian principle of letting alone with unconscious supervision, in a carefully guarded environment which supplied a great number of centres of interest that were full of indirect suggestion. No formal teaching of any kind was allowed until the end of the sixth year, but all kinds of questions were carefully answered, and effort was made to see that the answers were clearly understood. All baby talk was forbidden, and great care was taken to enunciate distinctly. Surroundings were carefully planned to meet the growing needs of the child from the moment he began to notice things. The result is therefore one of spontaneous development of self-activity, produced as a result (1) of suggestion based upon a carefully considered environment; (2) of accurate and sympathetic explanation given only when asked for; and (3) of carefully graded steps that were taken one at a time. Self-restraint upon the part of the parent or teacher is a necessity when developing children, in order to prevent giving more information than the child can absorb.'

The record, showing the child's first drawings, writings, and early attempts at paper cutting are well worth the attention of teachers.

On Oct. 14th Professor Miall, of the Yorkshire College, Leeds, lectured to the Manchester Branch of the Teachers' Guild on the subject of 'Children's Curiosity.' Curiosity, he said, was often considered a doubtful virtue, and the irrepressible boy who asked one question before another was answered, was often a terror. Nevertheless those who only treated curiosity with repression were neither fit to be parents or teachers.

Some schools quenched curiosity: long hours, lessons, and books in the hands of a dull teacher, were effective in crushing it.

Children generally went to school too young; and the apparent docility produced at the end of their school course was often only stupidity.

Curiosity was common to children with other young animals. The parents should train it by intelligent talk. He illustrated this by describing talks with his children on the steam on the window, or the clover leaves in the garden. The same method could be used in all subjects, but living plants and animals were singularly attractive.

Collections were not desirable, especially competition collections. All collecting should be for the school, not the individual, and each collection should have some specific object, *e.g.*, to illustrate the different methods of the dispersion of seeds. Lists of names and long words should be avoided. The object was to make the children observe and discover things for themselves. In geography they should examine, model, and make maps of the country round them. In history their first notions should be gained from the narratives of eye-witnesses; then the clear ideas of certain persons gained would form pegs on which other ideas could be hung. For instance, if a child had a lively idea of the personality of Henry II. and that of Becket, even the 'Constitutions of Clarendon' would cease to be a bugbear.

Two rules he gave: first, make the child wish to learn. Second, help the child to find out for himself.

What was the end of the business?

The curiosity of the child should intensify and mature into

the love of knowledge of the man. This could be stimulated partly by biographies, but most effectively by living example.

The good teacher never ceased to be a student.

No one was fit to be a teacher who was not prepared to give time and trouble to some study or investigation from which he could gain no personal advantage.

He concluded with two maxims, which, he said, gave the spirit though not the words of Pestalozzi:—

1. Never tell a child what he can find out for himself.
2. Everything learnt should be a step to something else.

An interesting discussion followed, chiefly on the practical difficulties of giving such teaching. In reply to questions, Professor Miall said too many subjects were usually attempted; and he thought twenty the largest number that could be well taught in a class.

E.I.S. NOTES, ETC.

BY JAS. PATERSON.

Ex-Vice-President of the Educational Institute of Scotland.

Sir Henry Craik on Inspection of Higher Class Schools. Sir Henry Craik's Report on the inspection of Higher Class Schools has been issued. The higher schools inspected during the past session numbered 83. Sir Henry claims for the inspection of these schools, begun in 1886, that it has had a good effect in raising the standard of higher education in Scotland by showing the difference between sound and specious work. While it is not the aim of the inspection to mould the schools according to one uniform type, Sir Henry is of opinion that it would be well, if it were possible, to have a limited number of officers set apart for this work, who might visit the schools, not at one season only, but at various times throughout the school year, as is hereafter to be the practice in Code schools. As in the case of the elementary schools, Sir Henry has to lament that the pupils are withdrawn at too early an age. He calls attention to the serious hindrance to efficiency caused by scholars coming to the secondary schools from the State-aided schools, who are not always fitted by previous education to take their places in the same class with those who have had the advantage of being trained with a view to higher education, and he expresses the opinion that there should be means for sending such children to the higher schools at an earlier age.

Leaving Certificate Examination. Sir Henry Craik, in reporting on the recent Leaving Certificate Examination, says he still finds occasion to condemn the practice of presenting candidates who have not reached anything like the prescribed standard. He also finds fault with the presentation of pupils of 11 or 12 years of age, and goes the length of suggesting whether it may not become necessary to fix a minimum age, below which no candidate would be admitted. The transference of Science and Art administration to the Scotch Education Department suggests an important development of the leaving certificate, by including in it certain science subjects, and Sir Henry hopes that the arrangements for this may be in operation next year.

Higher Grade Science Schools. At a general meeting of the West of Scotland Association of Secondary Teachers in Public Schools, held in Glasgow (Dr. Dickie, President, in the chair), the report of the Committee on the Scheme for Higher Grade Science Schools was submitted, and the following amendments were agreed to:—(1) That the merit certificate qualification for entrance to the Higher Grade Science Schools should not be insisted on for a year or two; (2) that the Education Department be respectfully urged to recognise alongside the science course a commercial or classical course on similar lines and with similar support from grants; (3) that the Department ought to apply the principle of capitation grants in all secondary departments in which a satisfactory curriculum is provided.

The New Rector of Aberdeen F.C. Training College. Mr. George Smith, M.A., Rector of Elgin Academy, has been appointed to succeed Mr. Adams as Rector of the Aberdeen F.C. Training College. Mr. Smith has had a distinguished career both as student and teacher, and he produced testimonials of his abilities and past success which leave no doubt that he will prove a worthy successor to Mr. Adams.

'The School Journey' Object Lesson. The boys in the upper standards of the Cullen Public School had lately an interesting educational outing. Accompanied by their teachers they proceeded to the policies of Cullen House. As they passed along they were made to repeat the names of all the trees that lined the avenue. At the Castle hill one of the teachers gave a practical lesson in Geography, pointing out the leading features from nature. On arriving at Cullen House, from which a good view of the valley formed by the Cullen Burn can be obtained, another teacher gave an object lesson on the 'Erosion of Valleys.' Such an outing could hardly fail to be enjoyable as well as profitable.

Glasgow F.C. Training College; Address by the New Rector. At the opening of the Glasgow Free Church Training College, the new rector, Mr. Adams, delivered an address on 'The Relations of the University to the Training College.' There was, he said, a vague impression that the training college and the university were opposed to each other. The two institutions, he maintained, instead of being antagonistic, were really complementary the one to the other. The university gave the wider culture and the broader sympathies that their profession so much required, while the training college gave, or ought to give, that mastery of technical detail, and that knowledge of method without which all scholarship, however broad, availed nothing in teaching. The interdependence of training college and university in the training of teachers was no longer a matter of controversy, it was cordially admitted by both parties involved. The present eminently generous scheme by which the Education Department encouraged university attendance among properly qualified students in the training colleges was merely a development of a scheme introduced by the Education Committees of the Established and Free Churches of Scotland. Those who girded against the narrowness of our Scotch churches should not forget that whatever breadth of culture university training had given to our elementary teachers was the direct result of the broad and intelligent educational policy that the churches introduced.

Remuneration of Evening School Teachers. The Scotch Education Department in Circular 225 relative to Art. 17 (b) of Evening School Code has given a very important pronouncement, and one which may affect not a few evening schools throughout Scotland, especially in country districts. The Circular says, 'It is desirable that the remuneration of the teacher (or teachers) should be settled definitely by the managers, by *means of written agreement*, before the session begins. This remuneration, it is suggested, should be either a sum named in the agreement, or an amount to be calculated at a fixed rate of payment for each evening that the school is opened, independently of the number of scholars on the roll. In cases where school-fees are paid, these should go into the school-fund, and should not be handed over to the teacher as part of his emoluments.' The Department holds that the handing over of the entire income to the teacher, subject to a deduction for the necessary expense of the up-keep of the school, is inconsistent with the spirit of Art. 17 (b), which says, 'The school must not be conducted for private profit, and must not be farmed out by the managers to the teachers.'

ELEMENTARY AND SECONDARY SCHOOLS.

Circular 231.

Scotch Education Department,
Dover House, Whitehall, S.W.,
11th October 1898.

SIR,—In consequence of enquiries which have been addressed to them, their Lordships think it well to give some further explanation of their views as to the organization of Science instruction in various classes of schools.

The schemes which they have proposed in aid of systematic instruction based upon the teaching of Science, or in which Science is a predominant element, are two, viz.:—(1) The Scheme for Higher Grade (Science) Schools explained in Circular 221, and (2) the Scheme for Schools of Science, to be found in pages 46 seq. of the 'Science and Art Directory,' revised to June 1898. The former is especially designed to apply to Secondary Departments, which,

while possessing a distinct organization, are connected with Schools aided under the Code, which possess the necessary equipment for giving practical instruction in Science, and in which the predominant aim is intended to be scientific. It is thought that the Scheme provides a course of instruction specially suitable for pupils leaving school at the age of 15 or 16, who will in after life for the most part follow industrial or commercial pursuits. But it will be observed that when the essential conditions of the Scheme are fulfilled, a large margin of time is left, which may be utilized to vary the curriculum, and still further adapt it to the wants of special classes of pupils. Their Lordships are therefore of opinion that the Scheme is compatible with as wide a variety of work as is either necessary or desirable in the case of the pupils referred to. Accordingly in the large centres of population where several schools of the same grade are available, it is in their view desirable on educational grounds that the Scheme for Higher Grade (Science) Schools, where it is adopted, should be made applicable to the advanced department as a whole, no exception being made of particular classes or pupils, and that the wants of pupils whose parents desire another type of education for their children (*e.g.*, Professional) should be provided for in other schools. But having regard to the existing organisation of these Departments, my Lords do not propose for the present to insist on such specialisation of function, and they will be prepared, on good reason being shown, to sanction the continuance of other courses parallel with the Science course.

In districts where it is not possible to provide separate schools giving different types of education, my Lords recognise that it may always be necessary to admit alternative courses of advanced instruction within the same school.

In all cases where such alternative courses within the same Departments are allowed, it will be on the understanding that the instruction of the pupils following these various courses shall be as far as possible separate and distinct, and that the grants under the provisions of Circular 221 shall be made only on account of the pupils who follow the Science course. Pupils taking other courses may still be eligible for grants under the Code.

Where similar aid is sought by Higher Class Public Schools, or Secondary Schools proper (which, in their Lordship's view, should contain a considerable proportion of pupils beyond the age of 16) my Lords are of opinion that as a rule the Scheme for Schools of Science should be adopted, though they will not refuse to entertain proposals for the adoption of the more Elementary Scheme should special circumstances render such a course advisable. Having regard to the increasing importance of a thorough training in Science, especially in large industrial centres, they would prefer to regard Schools of Science as absolutely independent institutions having their own premises, equipment and staff, in which instruction in Science would be carried to a much higher point than obtains at present, and they hope that such Schools of Science, in the proper sense of the term, will be before long established in the large towns. But for the present they will not refuse, on good cause being shown, to continue the existing practice of recognising, as Schools of Science, the Science sides or departments of Secondary Schools. They will require, however, that the Science side shall be clearly separated from the classical or language side of such schools, and that not merely shall the pupils following the Science course be separately registered, but that they shall receive separate and special instruction in the essential subjects of the prescribed curriculum, even when those happen to be common to both sides of the school. This condition being fulfilled, my Lords will not object to the instruction being given by members of the same staff who possess the necessary qualifications.

In view of the presumably greater age of pupils in a Secondary School, my Lords think it not unreasonable to require, as a condition of the continued recognition of a School of Science, that a considerable proportion of the pupils shall proceed to the advanced course, and their Inspectors will be directed to make strict enquiry into the reasons which prevent pupils who have entered upon the course, and are still in attendance at the school, from completing the curriculum.

My Lords are of opinion that harm has resulted in the past from the confusion of the functions of different classes of schools and from the attempt made, too often with inadequate means, to provide in the same school for types of education essentially diverse. It will be their endeavour, in the regulations which they may frame, to obviate this confusion, in the hopes that by giving greater definiteness and precision of aim to the various types of schools, they may secure a corresponding increase of efficiency. In any steps, however, which they may take, they wish to have regard to the existing organisation of schools, and they will endeavour as far as possible to avoid making demands for sudden changes in that organisation.

I have the honour to be, Sir,
Your obedient servant,
H. CRAIK.

NOTES FROM THE NORTH.

Circular 223. Probably no Circular issued by the Scotch Education Department within recent years has received so much attention or called forth such a consensus of opinion among teachers as that of August last, numbered 223. This is not due in the first place, or chiefly, to the new points it contains, for these were already set forth in this year's Code, but rather to the true educational spirit which breathes in almost every paragraph. The whole Circular but gathers up and crystallizes the ideas which have been simmering in the minds of those who have studied education and educational questions in their real bearings. By not a few it has been designated a revolution, and in many respects it appears so, but it is simply an evolution or gradual development of those principles which have been propounded and advocated by modern educationists. The greater freedom of classification accorded to teachers, the wider and more elastic curriculum, and the greater relaxation of 'the cast-iron rigidity of Education Codes during the past ten years' have all contributed to this advancement. The Circular, to change the metaphor, but places the cope-stone on the building which has been so slowly raised.

The more salient points of the Circular are:—

1. The new method of inspection.
2. The greater responsibility to be placed on school authorities.
3. The substitution of the merit for the labour certificate.
4. The uniformity of the school year.

Lord Balfour on Education. It was exceedingly fortunate that the opening of the new Grammar School at Paisley in September afforded Lord Balfour of Burleigh, the Education Minister for Scotland, such an excellent occasion for interpreting these changes, and adumbrating at the same time the future policy of the Education Department with regard both to Elementary and Secondary Education. Never before has the Education Department had so favourable an opportunity of bringing the various sections of the complicated educational machinery into harmony, for under its jurisdiction are now placed all schools—elementary, secondary, technical, agricultural, and science and art. And it is not too much to say that it seems to be taking a thorough and intelligent grasp of the educational needs of the country. Before, however, devoting attention to the field of operations on which the Department proposed to enter, he gave a luminous and comprehensive review of the past twenty-five years. It is evident that Lord Balfour is no pessimist; some may consider him too optimistic, but we are strongly of opinion that it is hardly possible to be too sanguine, when one considers the immense potentialities that at present lie latent. The progress during that period had been most marked. The inspection of higher schools, at first undertaken only after the co-operation of the local managers had been secured, and the Leaving Certificate examinations have established a high standard of education throughout these schools. By such means new life and vigour have been imparted, and as a proof of this he pointed out that more than 16,000 candidates presented themselves last year for the Leaving Certificate examinations, and that the certificate was accepted by the Universities of England and Scotland, and by all the leading professional bodies.

Educational Unity. He deprecated the separate treatment of elementary and secondary education. He maintained that the administration of secondary schools reacted beneficially upon the work of elementary education. A Department interested in the development of secondary education must inevitably become sensible that educational effort was not exhausted by exacting the utmost pound of flesh for every payment to an elementary school. The slower and more permanent elements of growth, the necessity for a liberal and not over-hasty grounding in elementary subjects, the expediency of giving to the primary school greater elasticity so as to enable it to adapt itself to higher requirements—all these, he noted, forced themselves upon the attention of a Department that interested itself in secondary or higher education.

The aim of the Department was the construction of an educational highway from the infant class to the ultimate entry upon the business of life, along which highway all may travel as far as circumstances and mental capacity enable each to go. This truly is a noble ambition, and worthy of the support and earnest co-operation of all teachers.

To free education he attributed the creation of a sharper line of demarcation between secondary and elementary education, with the result that an idea had got abroad that secondary education, in which he included technical, was only for the privileged classes. This would be disastrous to the poor boy of good talents and to the nation as a whole. It is not necessary here to follow the historical sketch further, but let us look at the most important part of his speech, viz., the field of operation that lies before the Department—its future policy.

Elementary Schools. With regard to Elementary Schools, and this in explanation of Circular 223, he pointed out that the Department recognised that a school must be judged chiefly, not by the individual results in all its classes, but on what it could accomplish for its pupils before they left. The methods are to be left to the school authorities. They must classify and arrange as they think best. The real aim of elementary education was not to be the labour certificate, which was only to be considered a loop-hole for those whose circumstances made longer attendance impossible, but the merit certificate, which would open the door to a secondary school, and would mark in a fairly definite way the dividing line between primary and secondary education.

To quote the Circular: 'There seems to be a very widespread impression that the possession of the Labour Certificate is evidence of the completion of a satisfactory course of studies in the Elementary School, instead of being, as it really is, a concession for the benefit of parents in necessitous circumstances. It certifies to the *minimum* amount of attainment with which children in circumstances of pressing necessity may be allowed to leave school, and it was never intended that this provision for exceptional circumstances should be taken as the standard of normal attainment.' The examination for Labour Certificates in future is only to be made on definite application through the School Board or the managers of a school, and children on whose behalf no application is made, or who are unsuccessful in the examination, must be regarded as still under obligation to attend school. The Department are to be congratulated on this quiet, yet effective, means of raising the standard of elementary education.

Merit Certificate. The requirements of the Merit Certificate have been altered by the omission of all reference to specific subjects. In the view of the Department, the Merit Certificate on its present basis ought to be regarded as the natural goal of every pupil in an elementary school. Some pupils, for economic reasons, may require to leave before they have reached the age of 13; but this is a misfortune, and it does not alter the fact that an elementary education, whose culminating point falls short of the standard of the merit certificate, is incomplete, imperfect, and proportionally expensive. It is interesting to note the standard of the merit certificate, which is in some sense an honours rather than a pass certificate, and will not be awarded for anything less than thorough proficiency in the fundamental subjects. Pupils will be expected to read at sight a passage from a modern author, a magazine or a newspaper, and should be able to give an intelligible account in their own words of the substance of the passage read, both orally and in writing. Some stress is to be laid on *oral reproduction*. They should also possess a sound knowledge of the arithmetic prescribed for the various standards up to and including Standard VI. Stress in this subject will be laid on facility and expertness in the four simple rules, and on the practical calculations required in Standard V. rather than on the more abstract parts of the work of Standard VI. In addition to these, a general knowledge of two class subjects will be required.

Specific Subjects. With reference to Specific Subjects, Lord Balfour made some trenchant criticisms, not too strong, however, we venture to think. The Department would discourage, he said, a long string of specifics, and they would not say that a scholar had done best who had secured passes in most of these subjects. That might be a matter of cram. What they would ask was really a higher educational aim. They sought to make elementary education thorough, to make it a tool which in his future course the pupil could wield with dexterity and ease. If he did that, it was far better for him to seek the specific subjects at a later stage and under conditions where it could not interfere with the thoroughness of his elementary training. (He was strong on the word 'thorough.') He would make far quicker progress when he turned to the secondary subjects with that equipment. In another part of his speech he said they would like to recast the system under which specifics were taught. It has been long doubtful whether the money and the time spent upon scraps of specific subjects were not wasted. Unless they were carried beyond the first stage they were of little advantage. It had often been urged that it would pay better (educationally he no doubt meant, though some Boards would interpret it differently) to give a higher grant for the third stage and sweep away the grants for the lower stages. We are of opinion they would do it best by making a *fixed grant* for schools that do the elementary work well, and by so doing they would remove the temptation to peddle with specific subjects.

This endeavour to raise the tone and quality of teaching all along the line, which Lord Balfour is about to inaugurate, will take time to come to fruition, and teachers, we feel certain, will help in every way possible to reach the desired consummation.

But the Department's field of operation embraces not only the supervision of all elementary education, it also includes that of all secondary education.

Science and Art. In regard to Science and Art, it was the duty of the Department to see how both might enter into general education; how each might be developed as part of a sound educational curriculum; how they might be most usefully adapted to the varying requirements of each locality; and how, above all, they might enlist the leaders of the various industries in advancing the scientific or the artistic instruction that might help the community with which they were connected. There can be little doubt that in this age of commercial competition there must be specialisation, and localities specialise in much the same way as individuals.

Two Grades of Schools. To this end the Department, he said, proposed to keep steadily in view two grades of schools—the elementary and the secondary. Each has its own sphere and primary aim. The one cannot assume the function of the other without mutual injury and without neglecting a part of its own proper work and producing waste and inefficiency. Each must be regarded, however, as equally necessary in the public interest. No more fatal error could arise than that, because elementary education was free, therefore none but the well-to-do classes were interested in higher education. Secondary schools must be available for all whose circumstances or talents made it expedient that they should take advantage of them. He was not prepared, however, either on behalf of the Government or himself, to have free secondary schools. Let the fees be kept, and places and bursaries provided as far as requirements demand and without crippling the school. But the first and most important thing is to have first-rate and well-equipped schools.

A Widened Curriculum. The great duty of the Education Department was to provide a widened curriculum. The burgh schools of Scotland have been too exclusively professional. The claims of science had not yet received sufficient attention, due partly to the heavy cost involved in scientific apparatus, but also to the belief that scientific education necessarily meant technical education, and that technical education meant a sort of imitation of workshops in the schools. The scientific training they now sought to give would not be instruction based on text-books and with very little relation to practical work, but would be given according to a well-defined curriculum, the parts of which would not only have a relation to one another, but to the ordinary and essential parts of a general education.

Higher Grade Science Schools. The Higher Grade Science Schools (Circular dated August 19th) are for those who have just completed their elementary education, but have

not the time for a full course of a science school. They occupy a position between the ordinary schools and the full science schools. The teaching in them must be in the hands of adepts specially qualified, and must not be intrusted to one teacher who is a prodigy of impossible accomplishments. The course must be practical and experimental, and the Department would insist on its being thorough and not mere book-work—on its being educational and not merely superficial.

Evening Schools. In regard to Evening Continuation Schools, he pointed out that, if the system thus sketched were properly administered, these schools would be of such a kind that at them would be given specialised secondary instruction suited to those who have passed beyond the stage of the school curriculum, and who know by experience what they need and what they find will be essential to them if they are to have an intelligent grasp of the business of their lives.

EDUCATION ABROAD.

BY E. E. FOURNIER D'ALBE, B.SC., A.R.C.S.

THE French Teachers' Associations have been discussing with much fervour the new provisions for their classification and remuneration proposed by M. Rolland's amendment, which was recently adopted by the Chamber of Deputies, and now awaits the sanction of the Senate. In the *Journal des Instituteurs*, Edouard Gillet summarises the teachers' wishes as disclosed during these discussions. The first demand is for an automatic advancement after a certain number of years, say five, spent in a given class. This would still leave room for a more rapid advancement of the more highly talented teachers. The male teachers somewhat ungallantly complain of the more advantageous classing of their female colleagues, which eventually gives them a start amounting to as much as 16 years. The remedy proposed is an equalisation of stages for the two sexes, although it is admitted that most of the advantages apparent among lady teachers are due 'to the relatively numerous resignations among them,' probably on account of impending marriage. Another demand is the pensioning of teachers after 25 years of service, or at the age of 55, if they demand it, and compulsory retirement at the age of 60. The temporary expedient by which the Minister of Education placed 300 teachers on the retired list in 1898 was in reality illegal, and the sooner that step is sanctioned by the adoption of the Rolland amendment, the better for him.

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Hungary will soon have reason to pride itself upon being the best educated country after Switzerland. Since 1869 the number of schools has increased from 13,798 to 16,884, while the number of pupils has more than doubled, and the amount spent on education has increased more than five-fold. In 1869 50 per cent. of all children of school age attended the schools. Now the percentage is 80. The increase in educational facilities is chiefly in the Hungarian schools as distinguished from those of other nationalities. Since 1880 the percentage of teachers speaking Hungarian has risen from 78 to 93. The Minister of Education, Dr. Wlassics, is credited with the plan of founding 1,000 additional monoglot Hungarian schools.

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The report of the school inspector of the canton of Uri gives a discouraging picture of a state of things which, if prevalent over a greater part of Switzerland, will soon imperil the boasted Swiss supremacy in matters of education. The fact discovered is that the proportion of intelligent children is diminishing. The cause is sought in the practice of drinking black coffee mixed with rum, and in early smoking. The children are easily corrected, but the parents show a criminal conservatism. They come and ask the teachers not to say anything against the black coffee as the children refuse to drink it. They also strenuously oppose any home lessons, arguing that if the children cannot learn what they should at school, they had better not go at all.

An article of peculiar interest is contributed by A. Grosskopf to the *Deutsche Blätter*. It gives instructions how the Greek heroic legends are to be explained to boys in the light of modern criticism. The first legend dealt with is that of Perseus and the Gorgons. The three Gorgons signify lightning, thunder, and the thundercloud. They lived in the extreme west, that being the region whence the Greek thunderstorms invariably come. The sight of the Medusa turned people to stone. So does the thunderclap: it paralyses people for the moment. The Gorgons had serpents in their hair. Those serpents signify lightning. They had terrible voices—like the thunder. They were dressed in black—like the thundercloud. They had wings—like the lightning flash. Perseus finds them asleep—the calm before the storm. And so on, the parallelisms are inexhaustible. What became of the thunderstorm after the beheading of the Medusa remains a mystery. Perhaps Benjamin Franklin was the true Perseus. Hercules is similarly dealt with. He was a succession of civil engineers and drainers of the sub-soil. The serpent of Lerna was a morass with many rivulets issuing from it. When one of them was stopped up, another issued at another spot. It was finally exterminated by burning the wood and producing free circulation of air. And so with Jason, and Agamemnon, and Odysseus. Alas for the heroes of our youth! A few more centuries, and our descendants will be learning all about the Great Gladstone Myth.

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A somewhat novel light is shed upon the 'godless' system of education at present in force in France by a quotation from the *Bulletin du Finisterre*, where a curé is reported to have said:—

> 'We must not blame the law of 1882, but that of 1850, in which Falloux introduced prayers into the schools, and abolished them in the homes. In my time, before 1850, what was called the *prière en commun* was said at night before going to bed. In the morning the mother would not let the children go out without asking: Have you said your prayers? No? Well, kneel down. And then she would say her prayers with them. When prayers were made compulsory in the schools, the zeal of the mother slackened. 'You can go,' she would say to her son or her daughter, 'you can say your prayers at school. I have no time to say them with you this morning.' This she would say at first once a week, then two or three times, and then every day. When she ceased to pray with her children, she ceased to pray for herself, therein often following the example of her husband. The home ceased to be the religious sanctuary it had formerly been. This is all the result of that unfortunate law of 1850, and not of 1882."

The abolition of religious observances in the schools, carried out by Jules Ferry, evidently did not tend to restore the 'home sanctuary,' but rather to uproot whatever religious feeling remained, or at least to divorce it from education, so that the two have now acquired a somewhat antagonistic position.

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In the *Praktische Schulmann*, Herr E. Hähnel advocates the cultivation of a uniform German pronunciation in the German schools. A little more uniformity would be, indeed, extremely desirable. Dialectic differences are very strongly marked in Germany, and have often been artificially cultivated. The Berlin grammar is notoriously bad. The inhabitants are unable to distinguish between the dative and the accusative cases. In Saxony, the vowels are all mixed up. Deutsch is pronounced Teitsch. "Der Kaffee schmeckt mich scheene" is said instead of "Der Kaffee schmeckt mir schön (gut.)." German orthography has only recently become unified. The Hanoverian dialect has been accepted as the standard of pronunciation, with the exception of the initial *s* in such words as *spät*, *stehen*, which should be pronounced like sch. To convince a Saxon that his pronunciation is still inferior to that of a Hanoverian is a matter of great difficulty, but one that must be vigorously taken in hand if Germany is to be united linguistically as it has been politically. The stage and the school are the two great agencies for effecting this. Children should be taught the correct formation of the sounds in the mouth and throat, and orthoepy will follow as a matter of course. Something similar might be accomplished in England with great advantage, where a Somersetshire man and a Yorkshireman are mutual foreigners as far as language is concerned.

OUR CLASS ROOM AIDS

NOTES OF TWO LESSONS.

By WILLIAM DONE, B.A., *Head Master, Brighton Pupil Teachers' School.*

I.—THE THERMOMETER.

HEADS.	MATTER AND METHOD.
I. *Experiments to show the expansion of liquids.* (*a*) Alcohol. (*b*) Water. (*c*) Oil of Turpentine.	Fill a small glass flask with coloured water. Fit a cork through which a long straight glass tube passes into the flask. Warm the water over a bunsen or spirit lamp. Notice the liquid rises up the tube. Fill similarly two small flasks of equal size to the preceding with alcohol and oil of turpentine respectively. Immerse all three flasks to the same depth in a vessel of warm water. The liquids will expand unequally. The alcohol shows the greatest, and the water the least expansion. From these experiments we may infer that change of temperature may be measured by the amount a given liquid expands.
II. *The Mercurial Thermometer.* 1. Construction.	Let the class examine the stem and bulb of an ordinary thermometer. It will be seen that the bore of the tube is so small that the mercury could not be poured down it. Some other method must be adopted. The tube is heated and then inverted in some of the liquid. Heating the tube has driven out some of the contained air by expansion, and on cooling some mercury is forced in by the pressure of the atmosphere to take the place of the expelled air. By repeating this process of warming and cooling in this way, sufficient mercury is driven into the tube. It is then heated to a temperature a little higher than we shall want to register, and the end of the tube just at the top of the mercury is hermetically sealed by a blow-pipe flame. Draw a diagram of the thermometer when in this state.
2. Graduation. (*a*) Freezing Point.	The bulb and part of the stem of the thermometer is placed in a receptacle of melting ice. After standing thus for about a quarter of an hour, a scratch is made with a file on the tube at the level of the mercury. This registers the temperature of the freezing point of water, which we know is '32' degrees Fahrenheit, or '0' degrees Centigrade.
(*b*) Boiling Point.	The higher or boiling point of the thermometer is found by immersing it in the steam coming from boiling water. This point is '212' degrees Fahrenheit, or '100' degrees Centigrade.
(*c*) The Scales.	Show two thermometers again, one registering Fahrenheit and the other Centigrade. It will be seen that there are 180 degrees or divisions between freezing and boiling point, while there are 100 divisions between these two points in a Centigrade thermometer.
III. *The Alcohol Thermometer.*	The mercurial thermometer has one disadvantage. The liquid freezes at —40° Centigrade, therefore, it cannot register temperatures below that point. Alcohol, on the contrary, will not freeze except under great cold, artificially produced, so we use alcohol thermometers for low temperatures. But alcohol boils at 78° C., while mercury boils at 350 degrees, therefore for recording high temperatures we use the mercurial thermometer.

II.—THE BAROMETER.

Articles of Illustration.—A glass cylinder or a tumbler, a basin of water, a boy's sucker, simple apparatus for making a barometer as shown by the diagrams in the ART MONTHLY.

HEADS.	MATTER AND METHOD.
I. *Simple Experiments to recall the subject of Atmospheric Pressure.* (*a*) Glass of Water. (*b*) Boy's Sucker.	Take a glass gas cylinder or a tumbler that has had its rim ground level. Completely fill the vessel with water. Place a piece of paper on the top and invert. What keeps the paper in its place and prevents the water from falling out? Take a boy's sucker and lift a slate or a stone with it. What makes the sucker adhere to the other article?
II. *The amount of the pressure of the Atmosphere on a square inch.*	Recall to the children's minds that the air which completely envelops us and extends upward for over a hundred miles, may be likened to a gaseous ocean in which we live immersed as fishes live in the sea. And like other gases it possesses weight, or, as we say, exerts pressure. The reason individuals are not crushed by this weight is that the pressure is all round us. Refer to the ease with which one can move even in a denser fluid like water. We are often told that the pressure of the atmosphere is fifteen pounds on the square inch. We are now going to see how we ascertain this fact.
III. *Construction of a Barometer.*	Take a straight barometer tube and completely fill it with mercury, taking care that no bubbles of air are left. Take a short piece of india-rubber tubing and fit one end of it on to the open end of the barometer tube. Connect the other end of the india-rubber with a short piece of straight glass tubing equal in bore to the barometer tube and open at both ends. Invert the arrangement and fix it upright as in the diagram. The mercury in the long tube will be seen to have fallen, leaving a space of some inches between it and the closed end. But why does not the mercury all come out through the short tube on the principle that all liquids find their own level? Evidently the column of mercury which stands at a height of about thirty inches is supported by something, and there is nothing else to support it but the pressure of the atmosphere on the open end of the short piece of tubing. If both tubes had an area of one inch, a column of mercury thirty inches high would be found to weigh practically fifteen pounds, therefore we say the pressure of the atmosphere is fifteen pounds on the square inch.
IV. *The Barometer registers variations of pressure.*	By questioning the children, elicit that the longer the column of air pressing on the open end of the barometer, the greater its weight, and *vice-versâ*. Hence infer that the barometer can be used to determine the varying pressure of the atmosphere. In a future lesson we shall deal more fully with this part of the subject and with other kinds of barometers than the mercurial one.

B.B. Sketches for lesson on BAROMETER
vacuum
tube of mercury
filled tube inverted in dish of mercury
TOY SUCKER OR CLEAVER
String
leather
STONE
vacuum
Same experiment using equal surfaces, e.g.
A. with air pressure
B. no air pressure
xB = column balanced by equally thick column of air
If bore = 1 sq. in. column weighs 15 lbs.
rubber
A
x
WHEEL BAROMETER
FAIR
DRY
CHANGE
RAIN
STORM
B.B. Sketches for THERMOMETER
bubble of heated air rising through mercury
drop of mercury replacing air bubble.
marking boiling point
steam
kettle
hermetically sealing with blow flame
marking Freezing Point
ICE

FULL NOTES OF A LESSON ON THE CATERPILLAR AND THE BUTTERFLY.

By WILLIAM DONE, B.A., *Head Master of Brighton Pupil Teachers' School.*

SEE SUPPLEMENT PRESENTED WITH THIS NUMBER.

Articles of Illustration.—The Diagram accompanying this month's PRACTICAL TEACHER, and specimens of eggs, larvæ and pupæ of butterflies.

HEADS.	MATTER AND METHOD.
I. *The Caterpillar.* Its general appearance and parts described.	A few days previous to the lesson ask the children to obtain each one or more caterpillars, noting the substance upon which they were feeding when taken. A sufficient quantity of the vegetable material should also be kept fresh for the insect to eat until required to be brought to school. They will find that lettuces, dock-leaves, and nettles are favourite spots with different sorts of caterpillars. By the time the lesson is given, the children will be ready with information derived from their own observation.
1. Its food.	The immense amount of food consumed, in proportion to the size of the insect, will be at once apparent. Caterpillars seem to do nothing but eat and sleep.
2. The hairy covering.	All the caterpillars will be found to be hairy, and, as we can see in the picture, the hairs are arranged in small groups. Now these insects move comparatively slowly, and could easily be snapped up by birds, were it not for these hairs, which would stick in the throat; so the caterpillar is fairly safe. Further observation will show that the hairs on different species of these insects vary greatly, both as regards length and texture.
3. The segments.	Looking closer, we can see that the body is composed of a number of rings. Between the rings the skin is more elastic and pliant, and this serves the purpose of joints in other animals. Insects generally have nine such segments in the long body, three in the chest, and one for the head.
4. The legs.	Let the children gently turn the caterpillars over on their backs, or else look at them sideways. On the chest segments are three pairs of legs. These six legs are always found on insects, variously modified. Farther back will be found four pairs of stumpy feet, much thicker, as may be noticed in the picture. These feet are peculiar to the caterpillar.
5. The breathing tubes.	Now let us search very carefully and notice some very small holes in the caterpillar's sides—a pair of openings practically to every ring. These openings are the ends of very minute tubes, which lead into two larger ones lying along each side of the body. From these principal tubes others branch off, and eventually form a network of fine pipes running to all parts of the animal's body. Caterpillars have no lungs as we have, nor gills as fishes have to obtain oxygen from the air, but the air circulates by means of these fine tubes, and is thus brought into communication with the blood vessels.
II. *Changes of Skin.*	Eating so voraciously as it does, the caterpillar grows rapidly, but unfortunately its skin does not keep pace with the requirements; the creature tends, as it were, to grow out of its clothes. When, however, it feels the skin getting too tight, the caterpillar hides for a short time in a secluded corner, and leaves off eating. Presently the skin splits down the back, and the insect emerges with a new suit. During a caterpillar's life, it may have five such changes of skin until it is quite full grown. The old skins are eaten up as they are shed. By this time probably, it has eaten one thousand times its own weight of leaves, and is about a month old.
III. *The pupa or chrysalis stage.*	The insect has now finished with its old life, and retires to prepare for a great change. Even before it ceases eating, signs of the change have begun. The skin now forming, instead of being similar to the former ones, is a thin covering for a new creature altogether. As the caterpillar hangs head downward attached to a twig, it gradually loses all power of moving about. By and bye the skin once more splits, and one can see the outline of a butterfly with its parts wrapped together, something like Italian mothers wrap up their babies. The pupa or chrysalis looks like a mummy butterfly. It gets a gilded appearance from a yellow gum exuding and covering it over, hence the word chrysalis. After another period of rest, the last case splits, as we notice in the picture, and the butterfly emerges with its perfect wings.
IV. *The Butterfly.* Its parts described.	In examining the body of the butterfly, we find that though the rings are not apparent, as in the caterpillar, yet we get the typical three segments—head, chest or thorax, and abdomen.
1. The head: Feelers, feeding trunk, eyes.	In place of jaws there is a curved trunk, since the insect will feed on the sweet juices of flowers. There are also long antennæ or feelers as they are called, though they probably are also organs of hearing or scent as well. The eyes are very wonderful; they are what are termed compound eyes, each one being a group of small eyes. We can see this in the picture. The eyes stand out well from the head, and enable the butterfly to obtain a great range of vision.
2. The scale-wings.	Next call attention to the two pairs of wings. We have all noticed, perhaps, in handling a butterfly, that some dust from the wings is apt to get rubbed off on the fingers. Examined under the microscope, this is found to be minute scales, very beautiful to view.
V. *The Eggs.*	The butterfly does not increase in size. In a short time it will deposit its eggs on some suitable leaf, which will be the feeding-ground of the young caterpillar. If the children look very carefully they may discover some of these for themselves. They are covered up with a coat of varnish, as the chrysalis was, to protect them from the weather, and though so small as to be visible only to a careful eye, yet are very beautiful when magnified. We can see the shape and some of the markings in the large drawing of the picture. The eggs have a yolk and a white portion, similar to a hen's egg. After a time, longer or shorter, according to the weather, the young larvæ or caterpillars cut their way out of the eggs, and set about eating and growing very rapidly.

THE PRINCIPLES AND PRACTICE OF CLASS TEACHING.

VULGAR FRACTIONS.

There is no reason in the nature of the subject why vulgar fractions should not be studied immediately after the simple rules. That would probably form the best arrangement **so far as the science of Arithmetic is concerned**. But there are very strong reasons against this order **so far as the learners of the science are concerned**. A child's learning of any subject depends very much on his **interest in the subject**. This is a very good reason why he should be introduced to applied Arithmetic as early as possible—as soon as he can add mentally, indeed, without waiting until he can do slate addition. And the same reason makes it the best arrangement to take up the systematic study of the compound rules, or the application of the simple rules to our tables of value and measure, as soon as the simple rules are pretty well mastered.

Again, we must keep in view not merely the teaching of Arithmetic as a means of mental training, but as a **practical science** to be used in the practical work of life. This consideration should be enough to determine us to adopt the order we have followed—namely, that of putting the child as early as possible in possession of a certain amount of **useful** knowledge of Arithmetic, instead of a wider **theoretical** and scientific knowledge of it. The school-life of many of our common school pupils ends very early. To delay the acquisition of this practical skill in favour of the acquisition of theoretical knowledge would prevent their ever reaching such a practical grasp of the subject as most people require in their daily lives.

It is clearly unwise, then, to begin the systematic study of fractional Arithmetic until solid attainments have been secured in the calculations most required in life. In recent Education Codes the tendency seems to be to introduce the study of fractions at an earlier stage. This can only be justified if the early instruction is of a practical nature, such as is likely to be of service to a boy leaving school, as most boys do, after passing Standard V.

> The same tendency to lose sight of practical utility is exhibited in other parts of the prescribed curriculum in Arithmetic. Interest, for example, is of much less practical use to the ordinary artisan than elementary mensuration, and yet the former finds a place in the school course in preference to the latter. Decimal fractions, again, have not the practical importance in a country like ours, where the decimal system of money and measurements is unknown, which would justify the time devoted to their study; and in a merely scientific aspect, the proper place of decimals would be at the beginning of the course, under the head of "Notation."
>
> It seems to be beyond doubt that our Arithmetical course in the common school ought to be guided by considerations of *practical utility* chiefly if not exclusively. And our estimate of practical utility should be based on the use to be made of Arithmetic by the great majority of our pupils in after-life. Nor need we fear that the proper mental training which Arithmetic can give will be lost by our adherence to this principle; the ordinary practical rules, if intelligently taught and understood, afford ample material for this training.

The first step in the formal teaching of fractions is to make quite clear the **meaning of the symbols used**, or to give the idea of a fraction and its notation. For this, concrete examples are necessary. But in the lessons given on this subject, both in books on teaching and as oral lessons by teachers, it seems to be assumed that children have wrought through the compound rules without having formed such ideas at all. Now, as a matter of fact, the idea of a fraction is necessary to the understanding of our symbols for a farthing or a halfpenny; and not only the idea of a fraction, but the knowledge that $\frac{2}{4} = \frac{1}{2}$, and that $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$. It is impossible to teach intelligently the reduction and compound addition of money without explaining the meaning of such symbols and operations. To begin, therefore, by assuming a class in Standard IV. or V. to be ignorant of the idea of a fraction, argues unintelligent work at an earlier stage; or if the class has been properly taught at the earlier stage, it makes the blunder of not connecting the present subject with those already known. It is only when the class is a very young one indeed that it would be appropriate to follow the plan of going through the actual halving of an apple or a potato in order to give the class the idea of $\frac{1}{2}$. And it may be added, that if such illustrations are used at this stage, the parts should also be weighed, in order to make it clear that the two parts are not really halves unless they are equal. Illustrations which are below the mental level of a class are as useless as those which are above it.

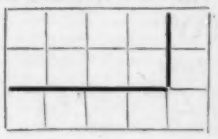
The most convenient **concrete object** for the early systematic lessons in fractions is a measured line drawn on the blackboard and divided into various parts—half, third, fourth, etc. This simple apparatus can be used to illustrate the meaning of the symbols used in fractions, and also to represent in a graphic way what the class already know of halves and fourths and the like.

The same simple apparatus will serve to show the equivalence of, say, $\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{8}$, $\frac{8}{16}$, and the like, and so to give an intelligent grasp of the rule for changing fractions to any desired denominator. At this stage the usual rule for G.C.M. and L.C.M. need not be used. The examples should all be such as have denominators which can be dealt with by inspection—that is to say, numbers not more than 100. And when the stage is reached where larger numbers must be used, the method of resolving them into factors should be employed whenever possible, rather than the more cumbrous rule.

The teaching of fractions practically consists of giving a grasp of the four simple rules as applied to them—of performing the operations represented by +, —, ×, and ÷.

Addition and subtraction present only one difficulty—children are apt to attempt the addition or subtraction of fractions of different denominations. To correct this it may sometimes be necessary to have the denominators *written in words*. This will impress on the class the fact that for present purposes these denominators are, as their name implies, merely *names*, showing the kind of thing to be added.

For the explanation of multiplication, a simple blackboard diagram is again useful. This diagram is most instructive when drawn as a rectangle, though the straight line may also be used. Suppose the example chosen be $\frac{2}{3} \times \frac{4}{5}$. The rectangle



will represent 1. Divide it vertically into 5 equal parts and horizontally into 3. Each section of the 5 is now divided into 3, and the whole figure into 15 equal parts. $\frac{2}{3}$ of the whole would contain 10 such parts, but only $\frac{4}{5}$ or 4 vertical parts of that segment are in question at present, and are seen at once to be 8 of the 15 small sections; hence $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$. The same diagram can be used for finding the product of any number of thirds and fifths. By varying the diagram, the principle is easily seen that the new denominator is equal to the product of the two denominators; that is, the unit has been divided into *thirds of fifths*. And the number of such parts in the result is either two rows of four or four rows of two, which gives the remaining part of the rule, that the new numerator is equal to the product of the numerators. After some illustrated examples, and others wrought without illustration by the pupils, the principle of cancelling may be introduced.

The rule for division of fractions is generally less easy to understand. It may be best introduced by making the dividend a whole number at first, so as to fix attention on the divisor. It may be approached in this way:—$60 \div 10 = 6$, but $60 \div 1 = 60$—that is, a divisor equal to one-tenth of the former gives an answer ten times greater. A divisor one-tenth of the second will give an answer ten times greater still—that is, $60 \div \frac{1}{10} = 600$; and from this the pupils readily see that to divide by $\frac{1}{10}$ gives the same result as to multiply by 10. This is easily seen to be the converse of the fact already known, that to multiply by $\frac{1}{10}$ is really to divide by 10.

The next step is to divide by a fraction whose numerator is greater than unity, such as $\frac{3}{10}$. Returning to the example chosen, $60 \div \frac{1}{10}$ will give a result three times too *great*, as the divisor $\frac{1}{10}$ is only one-third of the proper divisor $\frac{3}{10}$; hence the result, 600, has to be *divided* by 3. So the division of 60 by $\frac{3}{10}$ is completely performed when 60 is multiplied by 10 and the result divided by 3—that is, $60 \div \frac{3}{10}$ is the same as $60 \times \frac{10}{3}$. A few such easy parallels between multiplying and dividing will serve as an induction for the rule that to divide by a fraction we multiply by its reciprocal. And this rule holds good whether the dividend be a whole number or not.

Another method of illustrating the rule may be based on the principle that division is a shortened form of subtraction. Take a foot rule or draw a line representing one on the blackboard. The whole line represents 12 inches or equal divisions. To divide by 2 is to find out how often 2 inches may be taken away from 12; and the answer is 6 times. Divide next by 1, and in the same way the answer is 12 times. Divide next by $\frac{1}{2}$. A thoughtless class will be almost sure to give the answer at first as 6. It may be necessary, therefore, to remind them of the subtraction principle; the question really is, How often can *half an inch* be subtracted from 12 inches? Thus stated, the answer will be given as 24 times. If $\frac{1}{2}$ is the divisor, 36 times, if $\frac{1}{3}$, 48 times, and if $\frac{3}{4}$, 16 times, will now be readily given as answer. Write these down on the blackboard, and the same rule can be deduced—that the simplest way to divide is to invert the divisor and multiply.

Complex fractions, as they are usually called, form the best test of the pupil's grasp of the four simple rules as applied to fractions. Errors in the solving or simplification of complex fractions are generally due to a neglect of two general rules:—(1) **+ and − are to be treated as separating the quantities between which they stand; × and ÷ as binding them together.** (2) In simplifying a complex fraction, **re-write the whole fraction at each stage of the simplification.** Almost every serious error in dealing with such fractions is due to the neglect of one or both of these rules.

As an example of the first rule, such a series as $\frac{1}{2} + \frac{1}{2} \times \frac{1}{2} \div \frac{1}{2} - \frac{1}{2} \times \frac{1}{2}$ can only be rightly grouped in one way—$\frac{1}{2} + (\frac{1}{2} \times \frac{1}{2} \div \frac{1}{2}) - (\frac{1}{2} \times \frac{1}{2})$. To begin by adding $\frac{1}{2} + \frac{1}{2}$ is quite inadmissible.

The reason for the second rule is plain. In dealing with the various segments of a large complex fraction, the only safety from confusion lies in keeping those segments in their relative places, separated by the appropriate signs, until each part has been reduced to a simple fraction. Any other method is more liable to lead to error, and makes it almost impossible for the teacher or examiner to detect the stage at which the error appeared in the working.

CLASS LESSONS IN DOMESTIC ECONOMY.

BY ETHEL R. LUSH.

(*Organising Mistress to the Ipswich School Board, Head Mistress of the Ipswich Higher Grade Girls' School, Author of 'Chats with Children on Domestic Economy,' etc.*)

STANDARD V.

Lesson XX.

THE DIGESTION OF FOOD.

YOU are now quite familiar with the idea that food is used to repair wasting tissue, and that to perform this function it must enter and make part of the blood.

There is so much difference between the various substances which form our daily food, and the crimson, life-giving fluid known as blood, that you will be prepared to find that the changes which food undergoes in the body are as wonderful as they are complex.

The next time you eat a piece of bread and butter, think about what you are doing, and you will be able to identify the first processes of digestion.

When food enters the mouth it is seized upon by the tongue which passes it over to the back teeth to be broken up into small pieces. If you examine your own teeth by the aid of a small hand-glass you will find that they differ in size and shape. To the front are four, sharp, chisel-shaped teeth, specially adapted for cutting. These are called incisors, from the Latin *incido* I cut, and their work is to cut or bite off pieces of food.

Next to these, one on each side, are the pointed eye-teeth, which are so like the corner teeth of the dog as to be called canine teeth. They are specially used for tearing, and as you may see, are very strong. Next to these are double teeth with two ridges or cusps, called the bicuspids; and beyond these, the broad, irregular molars or back teeth which are used for grinding. It is interesting to observe how the teeth are adapted to the different varieties of food, cutting, tearing or grinding, as occasion requires.

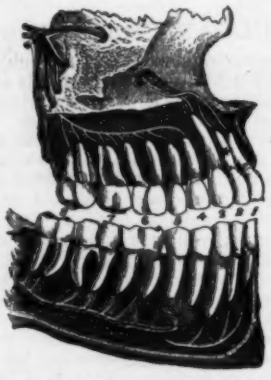
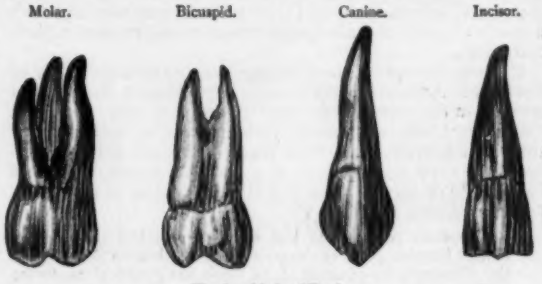


Diagram showing four kinds of Teeth.

While the food is undergoing *mastication*, as this breaking-up process is called, a watery fluid called *saliva* mixes with it, making it soft and moist.

Where does the saliva come from? Think of something nice to eat, and your mouth will fill with the fluid at once—



The four kinds of Teeth.

you can feel the little bubbles—some rising under the tongue, and others issuing from the cheek near the back teeth of the upper jaw.

Small tubes or ducts open into the mouth at these points, bringing the saliva from their respective glands, which are

Diagram of the Salivary Glands: P, parotid gland; *d*, its duct; S.M., submaxillary gland; S.L., sublingual; *c*, *c*, their ducts; T, tongue; L, lower lip.

found two under the tongue, two under the lower jaw, and a third pair below the ear.

Thin and watery as the saliva is, it has important work to do; for not only does it moisten and soften the food, but it even changes part of it in character.

Put a piece of potato or bread into your mouth, masticate it well, and keep it there for some time. Before long it will acquire a sweet taste, owing to the fact that the saliva has mixed with the starch of the bread or potato, and converted it into sugar.

Starch, you remember, is insoluble except in very hot water, and as a high degree of heat within the body is not practicable, the *starch is chemically changed* and then dissolved. You will learn from this the importance of eating slowly, for food which is hastily swallowed is neither well masticated nor sufficiently acted upon by the saliva.

When the food is ready to leave the mouth it is rolled into a neat little ball by the tongue, passed to the back of the mouth and into the food-pipe or *gullet*, which leads to the stomach.

Do not imagine that the food simply *drops* down the gullet, as you might drop a stone into a well, for if this were the case how could horses or cattle eat or drink with their heads lower than their bodies? *Swallowing* is quite a complex process, which we can imperfectly illustrate in this way. Let a piece of india-rubber tubing represent the gullet and a marble the ball of food. Put the marble in at one end of the tube and force it onwards to the other end by repeatedly squeezing the tube with your fingers just behind the marble. In the walls of the gullet are rings of muscle which allow the food to pass and then contract, forcing it onwards bit by bit just as your fingers force the marble. The difference lies in the fact that whereas the marble proceeds in jerks, the gullet keeps up a wave-like movement.

Before you can learn about what goes on in the stomach you must understand something of its position, shape, and structure. Look at a physiological diagram showing the position of the organs of digestion; they are all found in the abdomen. To

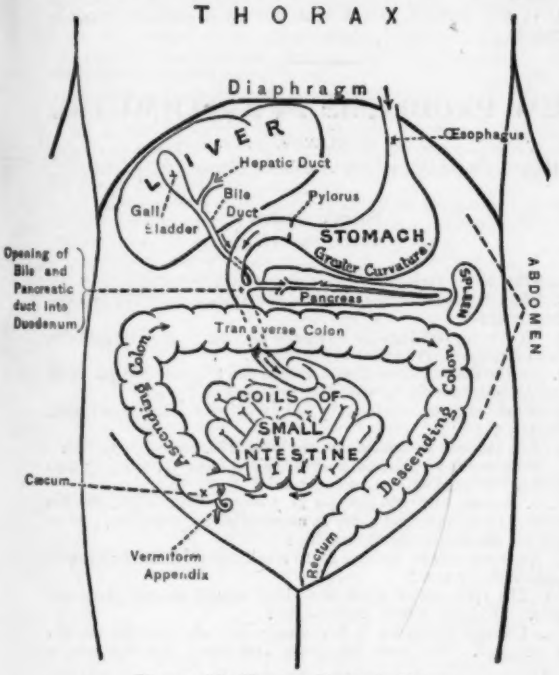


Diagram of the Alimentary Canal in the Abdomen.

the right in the upper part of the cavity is the large, reddish-brown *liver*. To the left and partly over-lapped by the liver is the pear-shaped *stomach*. Behind the stomach, and showing just below it, we find the *pancreas* or sweet-bread. The small purple-grey *spleen* is tucked away to the left of the stomach; and almost filling the lower part of the abdomen is the long much-convoluted tube known as the *intestines*, the small intestine lying coiled and twisted up in the middle, the large intestine bounding it on three sides.

Returning to the stomach, we find it to be a bag some ten inches long, with a strong, muscular coat. The inner lining of the stomach contains multitudes of tiny, tubular glands and blood-vessels. You will understand better what takes place in the stomach if you try one or two experiments. Put into a large test-tube or glass tumbler some pieces of lean meat cut small to imitate mastication. Add to this a few drops of spirits of salt (hydrochloric acid) and pepsin solution. Heat the contents over a spirit lamp until they are about the heat of the body—98° 4′ Fahr. Keep up this temperature by standing the tube in hot water; from time to time stir the mixture well to make sure that all parts of the meat are brought into contact with the fluid. At the end of four or five hours you will find that the meat is completely dissolved. Treat pieces of potato, sago, fat of meat or any heat-giving food in precisely the same way, and you will find that they are not changed at all.

What does this teach us? When food enters the stomach a powerful liquid, known as *gastric juice*, containing hydrochloric acid and pepsin, is poured from the tubular glands. At the same time the muscular walls contract and thus churn the food about until every part is mixed with the gastric juice. This continues for four or five hours, at the end of which time the *nitrogenous foods are dissolved*, as you have seen from the previous experiment.

Fats and starches, on the other hand, no matter how long they are in the stomach, remain unchanged; gastric juice has no power over them.

Another experiment will enable you to understand how the dissolved nitrogenous foods—peptones as they are now called—enter the blood. Make a solution of sugar by dissolving a table-spoonful of sugar in half-a-glassful of water, and pour it into a sheep's bladder. Tie the bladder firmly, and float it in a bowl of clean water. After a while you will find, on tasting the water in the bowl, that it has acquired a sweet taste, proving that some of the contents of the bladder have passed or *diffused* through its membranous walls.

It is much in this way that peptones enter the blood. The walls of the minute blood-vessels of the stomach are very thin, and peptones are remarkable for their diffusibility. All this time the stomach has been a closed bag, but now that the nitrogenous foods are dissolved an opening is disclosed to the right, and the undigested foods pass out into the small intestines.

Immediately this occurs two juices issue from an opening in the walls of the intestine. One of these, the *bile*, comes from the liver, where it has been stored up in the gall-bladder; the

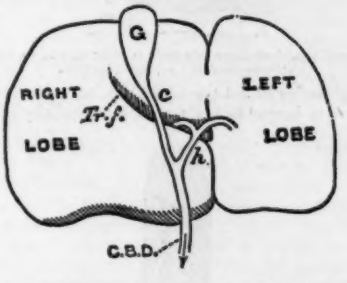


Diagram of the Under Surface of the Liver: G, gall-bladder; *c*, duct from gall-bladder; *h*, hepatic duct from liver; C.B.D., common bile duct, passing towards duodenum; *Tr.f.*, Transverse fissure.

other comes from the pancreas, and is called the *pancreatic juice*. It is very much like the saliva in character, so you will not be surprised to hear that its work lies in acting upon those starches that escaped action in the mouth, and converting them into grape-sugar. When this change has been brought about, the sugar diffuses through the walls of the tiny blood-vessels in the small intestine, and thus becomes part of the blood.

We have now only the *fats* to deal with; and, strange to say, the manner of their digestion differs entirely from that of other kinds of foods. They are not changed chemically like starches, nor rendered soluble like proteids; neither do they enter the blood by diffusion.

Fatty food is acted upon chiefly by the bile, though the pancreatic juice assists; the combined action of the juices serves to break the fat up into very minute particles, until it is reduced to the consistency of a fine cream; this process we term the *emulsification of fats*.

Look at this bottle; it contains water, to which I will add a spoonful of oil. On vigorously shaking the bottle the oil separates into globules, but when I put the bottle down the oil quickly collects into one mass on the surface.

The next experiment will show you how fat can be emulsified. Put some lard or dripping into a glass, and add a little warm water and some bullock's gall, which the butcher will give you. Shake the contents well, and you will observe that the fat breaks up into very minute globules, forming an emulsion. This is what takes place in the small intestine, for bullock's gall corresponds to our own bile.

When the fats are thus emulsified how do they enter the blood?

Lining the walls of the small intestine are delicate finger-like processes called *villi*, which stand out from the surface,

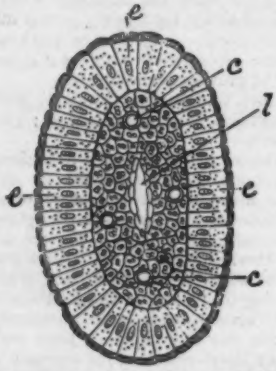
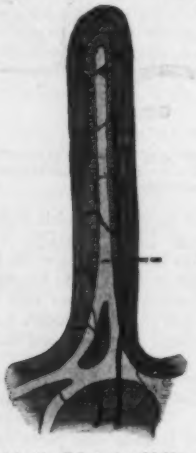


Diagram of the Transverse Section of a Villus, very highly magnified: *e*, *e*, *e*, columnar cells; *c*, *c*, blood capillaries; *l*, lacteal. The tissue between cells *e*, *e* and the lacteal is lymphoid.

somewhat like the pile of velvet. Under the microscope each villus is found to contain a minute tube, blind at one end and milky in hue, called a lacteal.

Wall of Ileum of Cat, three times enlarged: *v*, villi; *a*, mucous membrane; *s*, submucous coat; *m*, muscular wall.

The tiny globules of fat pass into the lacteals, and are conveyed by them to larger lacteals, which eventually join to form



A Villus of the Small Intestine (highly magnified).

one tube, about the size of a crow's quill. The thoracic duct, as this tube is called, passes up on the inner side of the back-bone, and pours its contents into the blood at the junction of two great veins on the left side of the neck, and thus, after making a circuit of almost the whole of the trunk, the fats enter the blood.

Remaining in the small intestine are certain waste matters which have escaped, or defied digestion. These pass onwards to the large intestine, and, in due course, are excreted from the body.

SUMMARY.

The Digestion of Foods.

1. *Mastication* by the teeth ... { 4 Incisors, 2 Canines, 4 Bicuspids, 6 Molars } in each jaw.

2. *Insalivation.* The food is mixed with saliva which (*a*) moistens it, (*b*) converts starch into sugar.

3. *Swallowing.* The food is forced by muscular contraction down the gullet.

4. *Digestion in the Stomach.* Nitrogenous foods are converted into peptones by the gastric juice and enter the blood by diffusing through the walls of the blood-vessels of the stomach. Sugars and mineral salts are also absorbed in the stomach.

5. *Digestion in the Small Intestine.* The *starches* are converted into sugar by the pancreatic juice and absorbed by the blood-vessels.

The *fats* are emulsified by the combined action of the bile and pancreatic juice. They are then absorbed by the lacteals of the villi, carried to the thoracic duct, and poured into the blood at the junction of two great veins on the left side of the neck.

6. *Waste matter* passes into the large intestine and is excreted.

NEW PROBLEMS IN ARITHMETIC.

BY T. B. ELLERY, F.R.G.S.

1895–6 *President of the National Union of Teachers.*

Fourth Series.

STANDARD II.

A.

1. What is the 79th part of the product of 632 and 26?
2. What is the difference between the 13th part of 455 and the 19th part of 836?
3. How many shillings do I require in order to give 18 pence to each of 60 boys? (12 pence = 1 shilling).
4. On the 18th October 1898 a woman was 86 years of age. How many days had she lived, reckoning 365 days in a year?
5. What number, divided by 56, will give the same result as 11,344 ÷ 16?
6. Add the sum and difference of £6 8s. 4½d. and £3 17s. 6¾d.
7. John earns 2½ guineas a week, and spends 5s. a day (7 days 1 week). What does he save in a week?
8. A woman sold 180 oranges in 3 days. On the first day she sold 88, and on the second day as many as on the third day. How many did she sell on the second day?
9. Eggs are sold at the rate of 16 a shilling. How many can be bought with £7 10s.?
10. The 17th part of £408 is divided equally among 5 boys and 3 girls. How much does each receive?
11. I bought butter for 1s. 8d., cheese for 10d., beef for 6s. 4d., and 24 eggs. The total bill being 10s. 10d., find the cost of an egg.
12. I have 210 pens and a number of pencils. For every 5 pens I have 3 pencils. How many pencils have I?
13. Five half-crowns are divided equally among 17 girls and 13 boys. How much will each receive?
14. Divide the difference between 1½ guinea and £2 5s. 6d. equally among 4 boys and 3 girls.

B.

15. I sold two horses for sixty guineas, gaining £7 10s. on the sale of one and six guineas on the other. What did I give for the two?

16. 468 sovereigns were divided among nineteen men. One man received 36 sovereigns and the rest were divided equally among the other men. How many sovereigns did each of these receive?

17. A man spent £17 in 5 days. He spent £4 10s. on the first day, and £6 10s. on the second day. What did he spend on each of the other days, taking one day with another?

18. A man had 4½ guineas. He spent £3 15s. How many sixpences had he then?

19. How many halfpence are there in the sum of 16 crowns and 16 florins?

20. A man sold 260 eggs in 3 days. On the first day he sold 108, and on the second day as many as on the third day. How many did he sell on the first day more than on the third?

21. How many florins are equal to 528 half-crowns?

22. In 1898 a man was 56 years old, and his son's age was just one half of that. In what year was the son born?

23. In 1898 a man was 39 years of age. At what date will he reach his 50th year?

24. A horse and a cow together cost £70 10s., and the horse cost £16 10s. more than the cow. What did the cow cost?

25. A man gave 60 oranges at a halfpenny each in exchange for 12 pounds of sugar. What was the price of the sugar per pound?

26. Tom works 8 hours a day at 7d. an hour, and Fred 9 hours a day at 8d. an hour. How much does Fred earn more than Tom in 3 days?

27. I buy books at the rate of 5 for 2s. How many can I buy with £4 10s.?

28. A woman bought 480 eggs at 15 for a shilling. She sold them at a penny each. Find her gain?

C

29. A man had 2,200 oranges. 8 men bought 125 each, and the rest were sold to a number of other men, each man buying a box holding 75 oranges. How many buyers were there in all?

30. The sum of 80 guineas is divided between 18 men. 7 receive four guineas each, and 6 others receive seven guineas each. How many guineas are left for each of the others?

31. I had 25 guineas in a bag. I paid 100 men a shilling each, and twice that number of men two shillings each. How much had I then?

32. There were 300 boys in a school. 80 received a penny each, 150 received twopence each, and the rest threepence each. How many pence did they receive in all?

33. A man spent 18 pence in nuts at 20 a penny. He sold them at 90 for 6d. What did he gain?

34. I wish to make a journey of 250 miles by rail (the charge being one penny a mile), and I have in my pocket 3 half-crowns, 2 florins and 3 sixpenny pieces. How much more do I require to be able to pay for the ticket?

35. The contents of 12 boxes of pens, each containing 144, were divided equally among 156 boys and 60 girls. How many did each receive?

36. 25 men saved in all £1,592. 9 of them saved £56 each. How much did each of the others save, taking one with another?

37. There are 120 boys in a school. I wish to give one half of the boys a penny each, and to the other half twopence each. How many half-crowns do I require?

38. I bought 4 score of apples at a halfpenny each, and sold them at a total profit of 1s. 8d. What did I charge for each apple?

39. A man buys pears at 1s. 3d. a dozen, and cocoanuts at 2s. 6d. a dozen. What does he pay in all for 48 pears and 72 cocoanuts?

40. Apples are sold at 6 for 4d., and pears at 5 for 6d. What is the total charge for 36 apples and 30 pears?

41. A man bought 360 bottles of ink. He sold one fourth of them at 6d. a bottle, and the rest at 1s. a bottle. What did he receive for the lot?

42. Hats are sold at 8s. 6d. each, and a pair of boots at 3s. 6d. more than that sum. What shall I pay in all for 3 hats and 4 pairs of boots?

ANSWERS.

1. 208.	15. £49 4s.	29. 24 buyers.
2. 9.	16. 24 sovereigns.	30. 2 guineas.
3. 90 shillings.	17. £2.	31. £1 5s.
4. 31,390 days.	18. 39 sixpences.	32. 590 pence.
5. 39,704.	19. 2,688 halfpence.	33. 6d.
6. £12 16s. 9d.	20. 32 eggs more.	34. 7s. 10d.
7. 17s. 6d.	21. 660 florins.	35. 8 pens.
8. 46 oranges.	22. 1870.	36. £68.
9. 2,400 eggs.	23. 1909.	37. 6 half-crowns.
10. £3.	24. £27.	38. ¾d. each.
11. 1d.	25. 2½d.	39. £1.
12. 126 pencils.	26. 4s.	40. 5s.
13. 5d.	27. 225 books.	41. £15 15s.
14. 2s. each.	28. 8s.	42. £3 13s. 6d.

THE INSPECTOR'S NOTE-BOOK.

BY AN INSPECTOR OF SCHOOLS.

School Sports. Continuing my remarks upon school sports I would say that when properly controlled and organised in the interest of the scholars *en masse* no fault can be found. The same object which obtains with regard to the ordinary subjects of the curriculum, should hold good in the playing fields. If, however, through the demands and necessities of membership of a league, the cricket, for example, merely resolves itself into the survival of the fittest, then very little good is accomplished. You have a school of 200 boys. The best dozen of these represent the school in cricket matches. No encouragement is given to the other 188 to take up the game. Oftentimes the cricket eleven are almost deified, and as a consequence think athletics quite their primary business. When such is the case trouble ensues. The discipline suffers.

'Mens sana in corpore sano.' Personally though an ardent advocate of the *mens sana in corpore sano* principle, and a strong believer in development of the physique, I do not consider league competitions the proper mode of bringing this about. Rather should I prefer to see some arrangement which would encourage the weaker ones to engage in games, for it is the improvement of the whole race that we want to bring about.

A very clear line of demarcation must be drawn between physical education, such as drill, and games entered into voluntarily by the scholars in the playground. Many fine qualities are developed in the games which cannot be learnt in class. To such the Iron Duke referred in his reference to the Waterloo victory.

Evening Schools. The evening schools will be less successful as regards numbers this session owing to the exclusion of the day-school children. In many cases these day scholars were the best part of the night-school. They were regular in attendance, attentive, well-behaved, and well-up in the subjects taught. It seemed, however, unnatural to see a class of children so young receiving instruction in overheated class rooms at night after putting in the whole day in school. Then again the environment of the night school in the matter of discipline and company was not always beneficial to them.

Evening School Record Book. Some record of the work done during the session in night schools would be valuable to the Inspector as well as to others concerned. At the end of the session the needlework is not always of so practical a form as at the beginning, as most of the garments and dresses are completed. A record of what has been done throughout the session would help the Inspector to form a better judgment. In some subjects a short test on paper might be given occasionally. This would prove an incentive to the scholars, and help the teacher to gauge how far the lessons had been assimilated.

Little Manuals should be discarded during the Lesson. In far too many schools one still finds the teacher using little manuals in front of the class. The mental arithmetic lesson is wanting in vigour and life when the teacher cannot manage without a manual from which to read out questions. Of what use can a lesson in Elementary Science be if the teacher has to run to the text-book for every detail of an experiment? Text-books and manuals are all very useful in their proper place, which is not on the desk when the lesson is in progress.

Refinement and Culture. In some schools Guilds of Courtesy have been formed. This is a thing worthy of general attention. We can do with more culture in our primary schools. A boy may be a good writer and clever at his work, but, unless he is polite, there is something lacking. It is no mean task to put on any polish, especially in schools of special difficulty, and, until recently, perhaps, little time for attempting the task. That this matter has engaged the attention of some of the teachers the existence of these guilds testify. In too many cases one fears the work of refining is almost nullified by the home influences. I do not think, however, that even with the

embryo Hooligans the refining process can be entirely without result.

The Teacher's Common Place Book. Some masters and mistresses keep an exercise book for jotting down any wrinkles and suggestions in Schoolcraft which occur to them. A little note-book for the same purpose should be kept by every teacher. Say you teach Standard IV. If you kept a list of the common errors in spelling made during a year, would not this save time the second year you teach the same standard? The same applies to every subject. If you know the pitfalls you can economise time and labour.

Drawing under Whitehall Rule. Drawing should be treated in the same systematic way as the other subjects. Some teachers take freehand alone for the first half of the year, and then take up scale-drawing, geometry, and model-drawing. Is it not better to take each section of the subject each week? If you have a lesson of an hour and three quarters, why not spend an hour at freehand, and the remainder at some other section? All worked exercises should be dated, and it is of advantage to retain filled books until an Inspector has visited.

Exercise books should be enerally used. As a rule, in the upper standards exercise books are preferable to separate sheets of paper and slates. By using an exercise book the lad, the teacher, and the Inspector can gauge the actual and relative value of the work, and see the improvement or otherwise. Drawing-books should, for the same reason, be used in all standards but the first. Slate-work in the upper standards, except occasionally for arithmetic, should be discouraged.

ANSWERS TO CORRESPONDENTS.

I.H. wishes to become a Factory Inspector. He should apply to the Civil Service Commissioners for particulars in the first instance. Subsequently he will probably find it of advantage to communicate with either Mr. Skerry or Mr. Clark of Chancery Lane, London, the well-known Civil Service coaches.

Paisley.—Any university graduate may be recognised as a fully certificated teacher, providing that he holds a certificate of proficiency in the Theory and Practice of Teaching issued by a University or Collegiate body, and recognised by the Department.

W.H.K.—You cannot obtain your parchment unless your period of probation has been spent in one and the same school.

S.Y.—I know next to nothing respecting the Senior Certificate, Aberdeen University. Send me a copy of the syllabus, and state more definitely wherein you want aid. I should have thought the St. Andrew's L.L.A. would have been more your thing. We have a course for this diploma running at present in our columns. So many more enter for the L.L.A. that it would be easier for you to get help. I shall expect to hear again from you, and shall be glad to help one living in so remote a district.

Correspondence intended for this column should be addressed—Inspector, c/o the Editor, 33, Paternoster Row, London.

A VISIT OF INSPECTION IN DRAWING.

SOME curiosity, and perhaps a little anxiety, have been felt by teachers as to how the new visits of inspection for the purpose of reporting on the efficiency of the instruction in Drawing would be conducted. As I have lately been subjected to one of these visits, I have been asked by the Editor of the PRACTICAL TEACHER to narrate my experiences for the benefit of those of my brethren who have not yet had a similar experience.

When H.M.I., about four months ago, visited the department of which I have charge, he informed me that one of the Drawing Inspectors would be spending a short time in his district, and would examine into the state of the drawing in certain selected schools. I was therefore not surprised when I received an intimation a few weeks after the visit referred to that I was to be favoured with a call by the officer in question. About half of the schools taking drawing in the district were selected for inspection, and the selection seemed to be made so as to be fairly representative. The selection made comprised boys' schools in what might be considered as good, fair, and medium districts, and a girls' department was also included. The notice given to the various departments varied in length from a week to a fortnight, the visit being timed to take place during a drawing lesson in every case.

If all the Inspectors of Drawing are of the type of the gentleman who visited my department, teachers who have done a good year's work will have no reason for any anxiety. He proved himself a perfect master of his subject, was a skilful questioner, and had a very pleasant manner with the children. The drawing lesson with us is of forty minutes' duration, but as the inspection of the school extended beyond the lesson, I was asked to allow the boys to continue their drawing. The time taken up in inspecting a large school was about an hour and a quarter. No paper whatever was set. Every class was visited. Some books were seen in every case, and where the Inspector happened to drop upon some of the less creditable specimens the books of better boys were handed to him. In Standards I. II. and III. a fairly exhaustive oral examination was given. The equality of all right angles, the fact that the size of an angle does not depend on the length of the lines containing it, and the difference between vertical and perpendicular lines were particularly insisted on. The children were also called upon to point out examples of those lines in their class-rooms. In the Fourth Standard the questioning mainly concerned the construction of scales. Children were asked what would be the length to a particular scale of a line of given length. None of the answers involved fractions. In the Fifth, Sixth, and Seventh Standards oral questions were given on the value in degrees and in right angles of the three angles of a triangle, radius and diameter of a circle, isosceles triangle, and the result of bisecting its vertical angle. In these three standards a fairly thorough examination was given in the principles of Model Drawing. The perspective representation of lines lying horizontally was particularly dwelt on, and the difference in the perspective view according as these lines lie below, above, or on the level of the eye elicited. Not only were abstract questions set, but the Inspector, holding a slate or drawing-board in a horizontal position, pointed to particular lines, and wanted to know how they would appear in a drawing. The vanishing of parallel lines was also gone into. In addition to these questions, the Sixth and Seventh Standard boys were also questioned on the perspective view of the parallel planes forming the base and top of a cylinder in an upright position. The class was required to say what the representation of either of these would be when on a level with the eye, and how the other plane would be represented in the various cases when the base, or when the top of the cylinder, was on the eye level. The fact that the base and top would appear elliptical when the cylinder was below the eye level was a subject of questioning in both of these standards; and the Inspector was very anxious to see if the class knew that the lower plane would be represented by a broader ellipse than the top plane, and the reason for it. The scholars' drawing-books were also examined to see if this point had also been attended to in the teaching.

The above comprise the main points in the tests to which the various classes were put. During the course of his round of the classes, the Inspector dwelt strongly on the utility of getting Standard IV. boys to draw to scale the plan or elevation of some right-lined objects in the room, measured by the teacher for that purpose. He noticed that in the freehand of Standards III. and IV. we had, during the latter part of the year, been working from cards given to individuals as well as from large copies put up in front of the class. He expressed himself as of opinion that children in Standards III. and IV. should work freehand only from large copies. In a conference following the inspection, the Inspector expressed himself as particularly pleased at the variety of the right-lined copies shown in the books of Standards I. and II., and urged on us to make that variety as great as possible. Before he departed, we had the satisfaction of hearing from him that he intended to report very favourably on our drawing. I trust that will be the case with every reader of the PRACTICAL TEACHER who receives a similar visit.

OUR TUTORIAL SECTION

THE L.L.A. OF ST. ANDREWS.

B.—THE DEPARTMENT OF PHILOSOPHY.

LOGIC AND METAPHYSICS.

BY THOS. CARTWRIGHT, B.A., B.SC. (LOND.)
Author of 'Mental Science and Logic for Teachers.'

BOOKS TO BE STUDIED.

(1) Jevons' 'Elementary Lessons in Logic,' with Cartwright's 'Mental Science and Logic for Teachers.'
(2) Mill's 'Logic,' Books I., II. with chaps. 1–8, and 21 of Book III., and Douglas's 'John Stuart Mill.'
(3) Ryland's 'Psychology,' 7th edition.
(4) Fraser's 'Selections from Berkeley.'
(5) *For reference only*, Minto's 'Logic, Inductive and Deductive.'

Jevons' 'Lessons in Logic,' Lesson XVII.

Lesson XVII.—The task set in this chapter is to commit to memory the mnemonic lines, which, although unscientific, as Jevons states, yet serve a very useful double purpose. In the first place they constitute a ready means of recalling to mind the various valid moods of the four figures; and secondly, they inform us how to proceed in order to reduce the moods of the three imperfect figures (2nd, 3rd and 4th) to the first or perfect figure. Concerning this reduction it is to be remarked that logicians, following Aristotle, regard the first figure in which the major term is the predicate of the major premise, and the minor term the subject of the minor premise as the best and most telling form in which to throw an argument, mainly because in this form of argument the application of the Dictum de Omni et Nullo is so apparent. Next, it must be noted that there are two kinds of reduction, viz.: (1) Ostensive Reduction and (2) Indirect Reduction or Reductio ad Impossibile. The meaning of each letter in these mnemonic lines should be thoroughly understood by working the examples given in this chapter and in chapter XVI. of M. S. and L. It will be observed that *r*, *t*, *l* and *n*, as well as *b* and *d*, when they are not initial letters have no significance, and that the signification of the other letters is as follows:—

s = simple conversion
p = conversion by limitation (per accidens)
k = obversion
ks = contraposition
sk = obversion of the simple converse

} of the *preceding proposition.*

m = metathesis or transposition of the *premises.*
c = indirect reduction (conversio syllogismi, *i.e.*, changing the syllogism).

All the moods could be reduced to the first figure by indirect reduction, but this is only resorted to with Baroco in the second, and Bocardo in the third figure, because the ostensive reduction of these two moods yields a conclusion differing in form from our original conclusion.

It must be carefully noted that if Baroco and Bocardo are reduced ostensively we get conclusions which are respectively **Ferii** and **Darii**, a fact which is not indicated by the mnemonic lines. For this reason Baroco is also called Faksoko, and Bocardo is known as Doksamosk as is shown in M. S. and L. It is only when this form of expression is made use of that the signs *k* (obversion) *ks* (contraposition) and *sk* (obversion of the simple converse) are necessary. As indirect reduction is the method usually employed in throwing Baroco and Bocardo into the first figure, the terms Faksoko and Doksamosk are not included in the mnemonic lines, nor are they employed by Jevons. The student should, however, become conversant with these two forms of expression, and their signification. She should also spell the words as in M. S. and L., and not as in Jevons, *i.e.*, Baroco and not Baroko, Bocardo and not Bokardo.

In dealing with **I O** in order to show that from two particular premises no conclusion can be drawn, it is necessary to remember (1) that if there could be a conclusion it must be a negative one, as one of the premises is negative, and (2) that the predicate of this negative conclusion must be distributed, since all negative propositions distribute their predicates, and (3) this would necessitate a distributed major term as the predicate of the conclusion is the major term, but as the major premise is an "I" proposition the major term is undistributed, hence this conclusion falls under the fallacy of Illicit Process of the Major, and is consequently inadmissible. It may be useful to work out the example given by Jevons at the end of Chapter XVII., viz., to show that no valid universal conclusion can be drawn from EI. If such a conclusion could be drawn it must perforce be E, as one of the premises is negative. But E distributes both Subject and Predicate, *i.e.*, both the major and minor terms must be distributed which is not the case in EI, since both the terms of an I proposition are undistributed, hence an E conclusion from EI would involve Illicit Process of the minor.

Lesson XVIII. No difficulty will be experienced here except perhaps in remembering the names to do which attention should be paid to the etymology. Thus if we know that **enthymeme** comes from two Greek words signifying 'in the mind,' we shall easily understand and remember that some part of an enthymeme is understood in the mind, but not expressed in the argument. Likewise in the word **epicheirema**, which comes from two Greek words meaning 'in or upon the hand,' we have a hint that something is kept back, namely, some part of the prosyllogisms of which an epicheirema includes two, as will appear from the following examination of the example given by Jevons:—

All P's are A's
All B's are P's } Prosyllogism, with the major premise understood.
∴ All B's are A's

All Q's are B's
All C's are Q's } Prosyllogism with the major premise understood.
∴ All C's are B's

The conclusion of these two prosyllogisms are the premises of the syllogism proper, thus

All B's are A's.
All C's are B's.
All C's are A's.

The **Sorites**, or heap, is well explained in Jevons, so that all we need say concerning it is that it must be carefully understood, and that of this as of the other forms of syllogism referred to, the student must be able to give good illustrations, she must therefore study well all that is said on this subject, both in Jevons and in M. S. & L. As to complex syllogisms, such as the one proving the Persians to be worshippers of an insensible thing because they worship the sun, the student need not concern herself much, but attention should be paid to those syllogisms that appear to have four terms, but which in reality have only three, since the significance of such arguments so as to reduce them to syllogistic form is just the kind of problem likely to be set. The division into extensive and intensive syllogisms needs no comment.

Lesson XIX. This chapter is a very important one. At the outset should be noticed the unfortunate usage of the two synonyms 'conditional' and 'hypothetical,' to signify the one the genus, the other the species. This is all the more confusing because some logicians use 'conditional' as the genus, and 'hypothetical' as the species, whilst others reverse this order. Thus, we may say that

Propositions are { Categorical / Conditional { Hypothetical / Disjunctive.

Or we may reverse the order and write that

Propositions are { Categorical / Hypothetical { Conditional / Disjunctive.

The ancient usage was more consistent, the division being as follows :—

Propositions are { Simple = Categorical. / Complex { 1. Conjunctive = Hypothetical or Conditional. / 2. Disjunctive. }

It is a pity that this logical division has been departed from. Welton uses a threefold division into Categorical, Hypothetical, and Disjunctive. In comparing Chap. XVII. of M. S. and L. with Lesson XIX. of Jevons, it will be necessary for the student to take Jevons' Hypotheticals as the Conditionals of M. S. and L., and *vice versa*.

The characteristic of a complex proposition is the combination of two or more propositions in one premise, the propositions being so related that truth or falsity of one proposition, or one set of propositions, is made to depend upon the truth or falsity of the other proposition or set of propositions. The etymology of 'if,' which shows it to mean 'given' or 'granted,' is very helpful in this connection, since it shows the folly of denying the antecedents. If it is granted that iron is impure, we can proceed to the statement that it is brittle, but if this admission is not made we can make no progress whatsoever. It will not do then to deny the antecedent statement. On the other hand if the antecedent and consequent are so conjoined that the truth of the former carries with it the truth of the latter, then it must follow that if the latter is false the former must be false also, therefore, if we can deny the truth of the consequent statement progress is possible, since we can proceed to deny the truth of the consequent. This must be well grasped, and the student should look well into the examples given and into others supplied by herself, until she realises that the **antecedent must be affirmed or the consequent denied.** Those who do not despise a little mnemonic aid may like to be reminded of the fact that 'a' is the initial letter in both 'antecedent' and 'affirm.' The meaning of a **Constructive Hypothetical** (*modus ponens*, from L. *pono*, 'I place or establish') and of a **Destructive Hypothetical** (*modus tollens*, from L. *tollo*, 'I destroy') should now be clear. Note the conversion of hypotheticals to categoricals, and endeavour to convert the one into the other both ways, and then proceed to show the nature of the fallacy that is involved in divining the antecedent or in affirming the consequent.

Disjunctives are not quite so easy to fully understand. Note the definition **'a disjunctive major with a categorical minor,'** and observe that 'A is either B or C' may be expressed in this form, 'If A is not B it is C.' This shows the two possible courses to follow. If you accept the affirmative form, viz., A is C, you establish the connected negative, namely, that A is not B, hence you deny by affirming, which is the meaning of *ponendo tollens*. On the other hand, if you deny the truth of the affirmative statement, and say A is not C, you deny at the same time the truth of the statement that 'A is not B,' or in other words you establish the truth of the contradictory, namely, that A is B, so that by denying the one you affirm the other, which is the meaning of *tollendo ponens*, affirming by denying.

The Dilemma is by far the most interesting of the several forms of argument referred to in this lesson. Mansell's definition should be well learnt, **'a conditional major with more than one antecedent and a disjunctive minor.'**

Observe that there are two forms of the **Constructive Dilemma,** viz., the **simple** and the **complex,** the difference between which is most evident in the conclusion which in the former case is **categorical,** but in the latter **disjunctive.** Note also that the major of the Simple Constructive Dilemma has but one consequent, whereas in the complex form there are two different consequents, as the following comparison of the two majors will show :—

(1) If A is B, *C is D*, and if E is F, *C is D*.
(2) If A is B, *C is D*, and if E is F, *G is H*.

The Distinctive Dilemma has always a disjunctive conclusion, *i.e.*, it is always complex.

Observe the peculiar weakness of the dilemma, namely, that it is almost impossible to find two cases or 'horns' which shall exhaust all possible cases. As Jevons says, 'Almost anything can be proved if we are allowed thus to pick out two of the possible alternatives which are in our favour and argue from them alone.' The dilemma form of argument, however captivating it may be, is thus as a rule a most fallacious one. It only only remains to call attention to the fact that it was customary to meet a dilemma with a dilemma, as in the example quoted by Jevons.

Lesson XX. No part of logic is more important, and no part of it more contestible than that dealing with the classification of logical fallacies. The importance is evident from the fact that the whole aim and object is to guard against and detect fallacious argument.

Aristotles' division is followed, not because it is perfect, but because nobody has devised a scheme of fallacies simple and comprehensive enough to satisfy the general body of students. It is easy to understand the division into logical and material fallacies, nor is it difficult to see why the fallacies connected with syllogising should be set apart as purely logical. The mnemonic word **Eacdaf** will serve to quickly recall the list of semilogical fallacies, as the letters forming this word are the initial letters of the names of the semilogical fallacies, viz., Equivocation, Amphibology, Composition, Division, Accent, Figure of Speech.

Equivocation refers to the double meaning of **term,** whereas Amphibology draws attention to the double meaning of a **sentence** due to faulty grammatical construction. A loosely connected sentence may be understood in more than one different ways, hence the fallacy of amphibology.

The fallacies of composition and division are understood as soon as the difference between *cancti* and *omnes* is grasped. The double meaning of our word 'all' is in sharp contrast with the more logical Latin. Concerning Accent and Figure of Speech nothing need be said.

Lesson XXI.—Material fallacies are such as occur from an incomplete grasp, not of the meaning of words, but of the subject-matter of the discourse. They are, strictly speaking, beyond the pale of formal logic, strictly so called, which does not concern itself with the agreement of language with objective reality, *i.e.*, with things as they are, but with consistency, that is, agreement of conclusions with premises. Thus the greatest logical error is flying in the face of one's premises. Notwithstanding this, the semilogical fallacies are by far the most important, and must have careful study. The student will remember that logic is now allowed to include not only *formal* but also *material inference*, or the science of the investigation of nature in the search for truth, so that it would be better to say that these material fallacies belong rather to the second part of logic, namely induction, than to accuse them of having no place in logic at all.

Accident = (1) Argument from a general rule to a special case ; (2) from a special case to a general rule ; and, (3), from one special case to another. The Latin name for this fallacy is *a dicto secundum quid ad dictum simpliciter*. (From a statement under a condition to a statement without that condition.) The student must be able to recognise the fallacy of accident under this name, and must also be able to supply instances in illustration.

Irrelevant Conclusion = proving one thing, and pretending that another different thing has been proved. The Latin name for this fallacy, viz., *Ignoratio Elenchi*, *i.e.*, ignorance of that which has been refuted, very aptly describes this common fallacy. Note that the *argumentum ad hominem*, which is well expressed by the well-known practice implied in 'no case : above the plaintiff's attorney,' and the equally common 'playing to the gallery,' or as it is termed in Latin, the *argumentum ad populum*.

Petitio Principii = Begging the question, *i.e.*, assuming the very thing that has to be proved. Note the synonymous Latin term *circulus in probando*, by which this common fallacy is known.

The Consequent = a loose argument, in which the conclusion is not a valid inference from the premises. Its Latin name, *non sequitur* (it does not follow), indicates this, the contention being that the conclusion is a bogus one, for which the premises are no warrant.

False Cause = the assumption of a causal connection between two events because they are connected in time. One thing follows another, therefore it is caused by the other, is the unsound argument indicated by this name. The Latin terms, *non causa pro causâ* (to mistake for a reason which is not a reason), and *post hoc ergo propter hoc* (after this therefore, on account of this), must be known by the student, as the fallacy is most likely to be asked for under this guise.

Many Questions = an attempt to get an answer to a question which is expressed, which may be passed off as an answer to a question that was half implied but not expressed. The example given by Jevons is a very ancient illustration of this. It really is a double question, viz., (1) Have you begun to beat your mother ? and (2) have you left off beating your mother ? If the answer 'Yes' is given, the sophist would go on to assert that you have been accustomed to beat your mother, but have now discontinued that practice. This is the least likely of all the Material Fallacies.

Lesson XXII. This lesson on the quantification of the predicate is exceedingly interesting from the theoretical standpoint, although it is not likely to have much effect upon the system of Formal Logic handed down to us from Aristotle. The complexity that would follow its introduction is quite sufficient to prevent its adoption. It will be remembered that we assume A E I O to cover all possible propositions. In these four propositions there are eight terms, four of which are distributed, viz., the subject of A, the subject

and predicate of E, and the predicate of O, the remaining four terms being undistributed. This is claimed to be in agreement to ordinary usage.

It should, however, be possible, at least theoretically, to use all these terms twice over, viz., in an undistributed and in a distributed sense, using the words 'all' and 'some' to indicate whether or no a term is to be taken as distributed or undistributed. This exactly is what is done by the quantifiers of the predicate. The new propositions thus brought in are—

1. The Universal—U—.
   All equiangular triangles are all equilateral triangles.
2. E with an undistributed predicate—ɘ
   All planets are not some stars.
3. The simple converse of A—Y.
   Some elements are all the metals.
4. O with its predicate made particular—ω.
   Some men are not some savages.

It will be seen that the change consists in definitely stating whether *the whole or part only of the predicate agrees with or differs from the subject.*

The changes produced by the quantification are—

(1) All conversion is simple.

(2) All immediate references from affirmative propositions are according to the rule that '*whatever we do with one term we should do with the other also.*'

(3) The number of valid syllogisms is greatly increased. Thus using only U and Y the number is 62 exclusive of the 4th Fig.

The notation will present little difficulty. It is not important, but should be understood.

Note the new canon of syllogism and especially the meaning of 'worse relation.'

De Morgan's exception to the rule that from two particular premises no conclusion can be drawn should be noted, the condition being that '*actual quantities of the two terms are stated, and that these when added together exceed the middle also.*'

The name **Plurative Propositions** may possibly be set for explanation.

Lesson XXIII. is unimportant, and need not be carefully studied; a general acquaintance with its contents will suffice.

Questions from previous L. L. A. examinations :—

1. Construct a syllogism in Felapton, and express the same reasoning in the first and fourth figures. (1888).

2. Prove that in the first figure the major premise must be universal. (1888).

3. Define and exemplify the fallacies of (*a*) Division, (*b*) Accident, (*c*) Petitio Principii. (1888).

4. Construct a syllogism in Fesapo, and express the same reasoning in the first and second figures.

5.—(*a*) He that is of God heareth my words; ye therefore hear them not, because ye are not of God. (1890).

(*b*) If there were no dew the weather would be foul; but there is dew.
∴ The weather will be fine.

6. Explain the following expressions :—Summum genus, subaltern opposition, real propositions, cross division, fallacy of composition, contradictory terms, separable accident.

7. If the major premise of a syllogism in the fourth figure be O, what fallacy is committed? Reduce Baroco and Bramantip to the first figure. (1892).

8. Explain and exemplify the following fallacies :—Division, illicit process, ignoratio elenchi, petitio principii. (1892).

9. Construct a syllogism in Bocardo, and prove your conclusion by means of a mood in the first figure. (1893).

10. What is meant by an Epi-Syllogism, a Dilemma, the Fallacy of Composition? Give one example of each. (1893).

11. Test the following arguments, indicating the mood and figure of the fallacy committed, if any :—

(*a*) If he pleads that he did not steal the goods, why I ask did he hide them, as no thief ever fails to do.

(*b*) No innocent person should be condemned; this man should not be condemned, therefore he is innocent. (1893).

12. Enumerate the cases in which no valid conclusion can be drawn from two premises and show why O cannot be a premise in Fig. I., or a minor premise in Fig. III. (1894).

13. Give examples of arguments which are valid and which cannot be reduced to syllogistic form, and state why they cannot be so reduced. (1894).

14. Why is E I O valid in every figure and I E O in none? Can this be proved without trying the mood in each figure? Construct a syllogism in Ferison and reduce it to the first figure. (1895).

15. Explain carefully the terms :—Connotation, *infima species*, modality, *ignoratio elenchi*, formal cause, category, dilemma, circumstantial evidence. (1895).

16. Put the following arguments into logical form. If they are valid, give the figure and mood; if not, say what is the fallacy :—

(*c*) If the law is oppressive it ought to be repealed. You wish it to be repealed; so I conclude that you consider it oppressive.

(*d*) A majority of those present voted for the first resolution; a majority also voted for the second resolution : therefore some persons must have voted for both resolutions. (1898).

17. Under what conditions can there be a valid syllogism, (*a*) with a particular affirmative major premise, (*b*) with a particular negative major premise? Give reasons for your answer.

Notes on the Questions.

(2) Suppose the major to be particular, *i.e.*, I or O, then the minor must be universal, as from two particulars no conclusion can be obtained. It is required to show then that I E, I A, O E, O A are inadmissible as premises in the first figure. As from two negative premises no conclusion can be drawn, OE are impossible.

I E must have a negative conclusion and therefore a distributed predicate, which is the major term and this in I is of necessity undistributed.

I A exhibits undistributed middle, for the middle term is the subject of the I proposition and the predicate of the A proposition, both of which are undistributed.

O A fails from precisely the same weakness for the subject of O, and the predicate of A being the middle term, and being also undistributed we again have the fallacy of undistributed middle. Thus no syllogism in the first figure, *i.e.*, with the middle term the subject of the major premise and the predicate of the minor premise, having a particular major premise is possible.

5. (*c*) All God-fearers are *hearers* (undistributed).
   Ye are not God-fearers.
   ∴ Ye are not *hearers* (distributed).

This syllogism is of the first figure, because the middle term is subject of the major and predicate of the minor premise. But the predicate of the conclusion, which is a negative preposition, is distributed, therefore we commit the fallacy of illicit process of the major, for the major term—the predicate of the major premise—is undistributed, as this preposition, being an A preposition, does not distribute its predicate.

5. (*d*) If there were no dew the weather would be foul.
   There is dew.
   ∴ The weather will be fine.

The conclusion is invalid, as we have committed the fallacy of denying the antecedent. Besides the conclusion is irrelevant, as the major premise says nothing at all about fine weather, but simply gives the condition under which foul weather will occur. It may be thought that 'If there is dew, the weather will be fine,' is a valid inference from the statement that 'if there is no dew the weather will be foul'; but in stating that absence of dew is a mark of foul weather, we have no right to assume that there are no other marks of foul weather which may appear with a fall of dew, and so the presence of dew may coincide with the presence of foul weather. The only two possible valid conclusions obtainable for this major premise are got (1) by affirming the antecedent; (2) by denying the consequent, neither of which is done in the minor premise. Even if the inference referred to above were valid, the conclusion 'it will be fine' is the conclusion to quite another syllogism than the one given in the question. The possible conclusions are got thus :—

(1) If there is no dew it will be foul.
   There is no dew.
   ∴ It will be foul.

(2) If there is no dew it will be foul.
   It will not be foul.
   ∴ There is dew.

7. In the fourth figure the middle term is the predicate of the major premise, and the subject of the minor premise. Now if the major premise is O, the subject, which is the major term, is undistributed; but if one premise is negative, the conclusion is negative, and negative prepositions distribute their predicate, so that the predicate of the conclusion, which is the major term of the major premise, must be distributed. This is impossible, for, as stated above, the major term is the subject of the major premise which by the question is an O preposition, and has therefore an undistributed subject. The fallacy involved would be illicit process of the major term.

11. (*a*) All thieves hide.
   He hides.
   ∴ He is a thief.

This conclusion is invalid, because the middle term 'hides' is undistributed in both the major and the minor premises, which are both A propositions.

5. (*b*) No innocent person should be condemned.
This man should not be condemned.
∴ He is innocent.

The conclusion is invalid, because the premises are both negative, and from two negative premises no conclusion can be drawn. The fallacy would be the purely logical fallacy of negative premises.

The above answers have been given in order to give the student some idea of how to deal with the problems set in this part of the work at St. Andrews. The beginner will find some difficulty here, but constant practice will soon beget facility in dealing with syllogisms so as to detect any fallacy that may lurk in them.

Answers to the questions set are corrected by the author of this course at a charge of 10s. for the whole series of questions. The name and address of the student should be distinctly written on the first page of his MS., only one side of the paper should be written upon, each page should be numbered, and a stamped addressed envelope should accompany each instalment of work sent. With each batch of papers must be enclosed the current coupon of the PRACTICAL TEACHER, for as this offer is made in the interest of subscribers to the PRACTICAL TEACHER alone, on no account, and for no amount, can papers be received without the coupon.

All communications should be addressed 'L. L. A. COURSE,' c/o Editor *P. T.*

LONDON MATRICULATION.

June 1899.

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LATIN.

Latin Course for November.

1. Cicero 'In Catalinam,' I., Chapters 20–33.
2. Grammar. Numerals and Pronouns in the Accidence. In the Syntax read the Accusative and Dative Cases. Note the definition of a Transative Verb.
3. 'Anglice Reddenda,' 30–45.

Sentences from Bradley's Arnold, or Bayfield's, or Allen's Exercise Book.

Notes on Grammar.

The Numerals, cardinal, ordinal, distributive, and adverbial, are most important. Note that distributives are used (*a*) to denote 'so much a piece,' (*b*) with nouns that have no singular, or that have a different meaning in the singular, as *bina castra*, 'two camps,' *duo castra*, 'two forts.' (*c*) In multiplication, as *bis sena sunt duodecim*, 'twice six are twelve.' Be able to give a list of the numerals that (*a*) are declinable, (*b*) indeclinable, (*c*) sometimes declinable and sometimes indeclinable, like *mille*. Note that *unus* is used in the plural with words plural in form but singular in meaning, as *una castra*, 'one camp.' Distinguish *triceni* (30 a-piece) and *treceni* (300 a-piece).

Mille is generally used as an indeclinable adjective in the singular, but occasionally as a noun with a genitive case depending on it, *e.g.*, *mille equites*, '1000 horsemen' (sometimes *mille equitum*). N.B., *one* is not expressed with *mille*. In the plural *mille* is declined like a word of the 3rd declension, *e.g.*, *milia*, *milium*, *milibus*, and requires the genitive case, if a noun is used with it, *e.g.*, *duo millia equitum* '2,000 horsemen.' The genitive of words like *ducenti*, etc., ends in *-um* not in *-orum*. Note the declension of *duo* and *ambo*. *Duo* and *ambo* are found in the acc. pl., but *duos* and *ambos* are better forms. Note that the numbers, 20th, etc., are spelt either ending in *-esimus* or *-ensimus*. The adverb numerals have two forms—an older form in *-ens* and a later form in *-ĭes*. Note how fractions are expressed ⅓ *tertia pars*, ⅔ *duae partes*, ⅞ *duae septimae* (*partes*).

Master the declension of the pronouns, and learn the distinctions between (*a*) *quis* and *qui*, (*b*) *quid* and *quod*.

The normal distinction is this—*quis* is the masc. or fem. interrogative pronoun; *quid* is the neuter interrogative pronoun; *qui* is the relative pronoun masculine or the interrogative adjective masculine; *quod* is the neuter relative pronoun or neuter interrogative adjective.

It is very important to know the classes of verbs that govern the *dative*, as English equivalents of most of these words are transitive. Note as well that if the verb in the active does not govern the accusative case it is used impersonally in the passive; hence *persuadeo tibi*, 'I persuade you,' becomes in the passive *tibi persuadetur*, not *persuaderis*.

Among the verbs governing the *dative* the following are most important, and students should be able to form sentences showing their *construction*:—*Consulo, impero, invideo, credo, minor, adimo, resisto, pareo, subvenio, aemulor, placeo, expedit, licet, persuadeo, auxilior, indulgeo, faveo, nubo, noceo, adversor, irascor, studeo, maledico, medeor, obedio, confido, libet, contingit, accidit.* Some of these verbs also allow the accusative under certain circumstances. Note for example, *te consulo*, 'I consult you;' *tibi consulo*, 'I consult your interests;' *tibi impero ut hoc facias*, 'I order you to do this;' but *naves civibus imperat*, 'he orders the citizens to supply ships' (lit. 'he orders ships to the citizens'). This sentence if turned into the passive will become *civibus navibus imperantur*. *Hoc tibi invidet*, 'he grudges you this.' *Tibi mortem minatur*, 'he threatens you with death' (lit. 'he threatens death to you').

The verbs *iubeo*, *dilecto*, *sino*, &c., which, contrary to the general rule, govern the accusative, are important.

Contrast '*te iubet hoc facere*' and '*tibi imperat ut hoc facias*,' 'he orders you to do this.' Be able to give a definition and example of the following terms:—Ethical dative, predicative dative, adjectival dative, double dative (*i.e.*, the dative of the person and the predicative dative in combination), dative of advantage or disadvantage (dativus commodi and incommodi), cognate accusative, accusative of space and time, adverbial accusative, accusative of respect.

Note that the dative of the agent is used with the gerundive.

Learn the classes of verbs that can have two accusatives depending on them, and note what becomes of these two accusatives in the passive. The verbs of asking that do *not* take two accusatives should be known, *e.g.*, *peto*, *postulo*, *quaero*, etc., *hoc a te peto*, 'I ask you for this.'

Note how 'ago' is expressed by *abhinc* and *accusative*, as *decem annos abhinc*, 'ten years ago.'

The dative of the agent is generally confined in prose to its use with the gerundive, and sometimes with the perfect passive. In poetry the dative is found after all parts of the passive verb.

Learn a list of the prepositions that govern the accusative. Note the rule for expressing 'motion to,' which we have already given in solving sentences.

Practice Sentences.

1. Who could have doubted that Cæsar had been put to death by his enemies?
2. On learning that the spies had been seen by the enemy Cæsar resolved to march to the camp at Gergovia.
3. It cannot be doubted that he is making it his aim (*id agere*) to govern the kingdom wisely.
4. Each of us had tried (*nitor*) to persuade him to adopt this plan.
5. It is said that he was so brave that he never retreated (*pedem referre*) in battle.
6. What reason is there why you should obey this man?
7. Who do you think is ignorant (*ignorare*) of what he did four days ago?
8. The senate decreed (*decerno*) that this man should pay the penalty (*dare paenas*) of his crime.
9. So brave a woman as Camilla ought to be praised by the senate and the Roman people.
10. What is there which can now (*iam*) give you pleasure (*delecto*) in this town?

Typical Sentences.

(7) No one will ask your friend to spare this man.
Nemo amicum tuum rogabit ut huic parcat.

Notes.—(*a*) Whenever 'to' and the inf. in English express a purpose, the inf. must *not* be used in Latin prose. One of the commonest ways of expressing the inf. in such cases is by using *ut* (= in order that) and the subjunctive. If the inf. has a negative attached to it, *ne* is used instead of *ut*, *e.g. cum rogavi ne hoc faceret*, 'I asked him not to do this.' From this we deduce the following rule:—After verbs denoting 'ask,' 'command,' 'persuade,' 'advise,' 'strive,' and similar verbs, 'to' and the inf. are translated by *ut* and the subjunctive. (*b*) For the tense of *parcat* see Ex. 4 last month. The action of 'sharing the plan' is future to that of 'asking'; hence the present subjunctive is used, as 'will ask' is in the primary tense. (*c*) *parco* governs the dative. (*d*) *man* need not be expressed, *huic* is quite sufficient.

(8) Let each of you prevent the general from sacrificing his own interests to those of his country.

Vestrum quisque ducem prohibeat quominus patriam suam sibi anteponat (or *patriæ suæ se posthabeat*).

Notes.—(*a*) *Vestrum* is used because 'of you' is the partitive genitive. (*b*) Verbs of preventing, when followed in English by *from* and a verbal noun, are generally followed in Latin by *quominus* ('by which the less') or *ne* ('lest') with the subjunctive. *Obstare* also means to prevent, but, unlike *prohibeo*, which is a transitive verb, governs the dative. (*c*) Beware of looking out in the English-Latin Dictionary and writing down a literal translation of 'sacrifice.' Metaphor must be treated cautiously in Latin, and it is better for the beginner to avoid retaining the metaphor in his Latin version. Turn the metaphor into unmetaphorical English. Applying this process to this sentence we get as a result, 'to prefer one's country to one's self'; 'to prefer,' in this sense, is *antepono*. *Antepono* requires the accusative of the thing preferred and the dative of that to which it is preferred. *Posthabeo* can also be used. This requires the inverse construction. (*d*) *Country* is to be translated here by *patria*, since it means 'native land'; if opposed to *town*, it is translated by *rus*, *e.g. rus ibo*, 'I shall go to the country.' (*e*) *Let* and an infinitive are translated by the present subjunctive.

(9) No one could have doubted that so brave a man as Marcus ought to have gone to the camp at Capua without delay.

Nemo dubitare potuit quin Marcus vir fortissimus Capuam ad castra sine mora ire deberet.

Notes.—(*a*) After negative or virtually negative verbs of doubting, *quin* with the subjunctive is used to express 'that.' A rough rule for the general use of *quin* is this: Whenever 'but that' can be used in English then *quin* can be employed in Latin. (*b*) Many students will translate 'so brave a man as Marcus' by *tam fortis vir quam Marcus*.' Now *tam . . . . quam* are used only when there is a comparison drawn between two people. In this sentence this is not the case, and in this and in similar instances the *superlative* is used. Note also that *fortissimus Marcus* would not be good Latin. Adjectives are not used with proper names except the words *vir*, *femina*, etc., are also employed. (*c*) In English, we use the prepositional phrase 'at Capua' as an adjunct of the noun 'camp.' In Latin this is not done, and the Latins attached the phrase to the verb, and said 'to Capua, to the camp.' For the accusative see 2 (*c*). (*d*) Note the tense of the infinitives *dubitare* and *ire*. After *debeo*, *possum*, etc., the perf. inf. is not used, though the English equivalents of these verbs—'ought,' 'could'—are followed by the perf. inf. The action of the 'going' and the action of *debeo* are synchronous, therefore the present inf. is used (see 1). In English, as 'ought' is present and past, the past signification has to be expressed by using the perf. inf.; the same holds good for *possum*.

Test Paper.

1. Give the other degrees of comparison of *peior*, *aecus*, *pius*, *nequam*, *novus*, *frugi*, *maledicus*, *beneficus*, *habilis*, *similis*, *mālus*, *pulcher*, *dives*, *senex*.

2. Decline throughout—*niger vas*; *niger senex*; *magnus canis*; *palus terrestris*; *anceps proelium*; *vetus nomen*.

3. Give the rules for the formation of the comparative and superlative of adjectives.

4. Give the gender and genitive case singular and plural of *quercus*, *ilex*, *custos*, *mos*, *seges*, *nubes*, *anceps*, *anas*, *ācer*, *arbor*, *linter*.

5. When are distributives used in Latin? Give examples.

6. Give the Latin for 1,000 foot soldiers, 2,000 soldiers, 2,024 men, 25 sesterces a piece, ten times four are forty, with 2,652 men, the 72nd year, ¾, ⅞, ½.

7. Distinguish *quis* and *qui*, *quid* and *quod*. Give examples.

8. Decline *aliquis*, *alteruter*, and *unusquisque*, in the singular.

ENGLISH.

Grammar: Adjectives.

History: from the death of William the Conqueror to the death of John.

English Notes.

History.—A description of the character of the various monarchs is often required. Lives of Lanfranc and Anselm are important. The Investiture dispute, in which the latter was involved, is very important. The claims to the throne of William II., Henry I., and Stephen should be known. The causes and results of the Crusades, with an account of those in which the English took part, should be mastered. Note the character of Henry I., his war with Robert, and the Battle of Tinchebrai. The perfection of the Conqueror's system by Henry I. should be known. Note the *Commune Concilium Regis*, the *Curia Regis*, the origin of *Itinerant Justices*, and the Court of Exchequer. Note the progress of the Civil War in Stephen's reign, the Battle of Northallerton, and the state of England at that period. Note how Henry II. restored order when he ascended the throne and succeeded in keeping down the powers of the barons and the power of the Church. The life of Becket is most important, involving, as it does, the struggle for power between the King and the Pope. The various legislative enactments, viz., the Statute of Clarendon, the Assizes of Clarendon, the Assize of Northampton, and the Assize of Arms, should be learnt. Note Scutage, the Inquest of Sheriffs, Recognitors, the germ of Trial by Jury. The Continental possessions of Henry II. should be known. Be able to discuss the Conquest of Ireland. The Battle of Alnwick and the Treaty of Falaise are important, on account of the claim to the supremacy of Scotland afterwards put forward by Edward I. In Richard's reign, notice the massacre of the Jews, the selling of the Sovereignty of Scotland, the Third Crusade, the revival of Danegelt under the name of Carucage. In John's reign, his quarrel with the Pope and Barons is most important. Note also the loss of Normandy, and be able to discuss the effect of this on the union of English and Normans in England. Be able to give an account of Stephen Langton. Know thoroughly the provisions of the Magna Charta. Note the Battle of Bovines and the Army of God and the Holy Church.

Grammar.—In this month's course attention should be paid to the following points:—Definition and classification of adjectives; the use of adjectives as attributes and predicates; reasons for and against regarding the article as a distinct part of speech; the advantages accruing to a language from the possession of articles; the derivation of numerical adjectives, especially twain, third, five, nine, ten, eleven, twelve, dozen, thirteen, twenty, score, hundred, million, myriad; the comparison of adjectives, regular and irregular; instances of double comparatives and double superlatives; comparison formed by vowel changes; comparatives formed by false analogy, *e.g.* 'farther'; adjectives that do not admit of comparison; discussion of the correctness of comparing words like 'perfect,' 'golden,' etc.; discussion of phrases like 'the largest circulation of any Liberal newspaper,' 'Eve, the fairest of her daughters,' 'more better' (*Tempest*), 'many a flower,' 'a few books,' 'the three first books,' 'our mutual friend,' 'a talented man,' 'a reliable person,' 'every other day,' 'the most unkindest cut of all.'

MATHEMATICS.

GEOMETRY COURSE.

Euclid's second book should be read, and a revision of the first book. Get up carefully the algebraic equivalents of those propositions of the second book which have them. Note that II. 11 is the geometrical solution of the equation—

$$x^2 + ax - a^2 = 0.$$

II. 8 is a proposition of but little importance.

Solutions to last month's riders.

(1) If any point D in the base BC of a triangle ABC be joined to the vertex A, we shall have

$\angle ADC$ greater than $\angle ABC$
and $\angle ADB$ " " $\angle ACB$ } I. 16.

Adding these equals—

The angles ADC, ADB are together greater than the angles ABC, ACB, and, since by I. 13 the former angles are equal to two right angles, it follows that ABC and ACB are together less than two right angles.

(2) Draw two lines, AB, BC, at right angles to each other and of lengths 2 and 3 inches respectively. Join AC.

Then $AC^2 = AB^2 + BC^2 = 4 + 9 = 13$.

$\therefore AC = \sqrt{13}$ inches.

(3) OA and OB are together greater than AB (I. 20)
OB " OC " " " " BC
OC " OA " " " " AC

Adding and halving, we get

OA, OB, and OC are together greater than half of AB, BC, and AC, *i.e.*, than half the perimeter.

Again, by I. 21,

AC, CB are greater than AO, OB
CB, BA " " CO, OA
BA, AC " " BO, OC

Adding and halving, we get

AB, BC, and CA are greater than OA, OB, and OC; or,

OA, OB, and OC are together less than the perimeter of the triangles.

(4) Let the diagonals AD, BC of a parallelogram ABCD intersect in O. Then the triangles AOB, COD are, by I., 26 equal in all respects. $\therefore$ BO = OC, and similarly AO = OD.

(5) is similar to (4), and easy.

Riders for October.

(1) If the middle points P, Q, R, S of the sides AB, BC, CD, DA respectively of a quadrilateral ABCD be joined, the figure PQRS is a parallelogram.

(2) Construct a triangle, given the lengths of two sides and of the median bisecting the base.

(3) To produce a line AB to H so that rect. ABAH = square on BH.

ARITHMETIC COURSE.

The previous work should be revised, and the chapter on Simple Interest in Pendlebury should be read, and some of the exercises worked.

Answers to last month's examples.

(1) 53·4836 or 53·484 to 3 places.

(2) ·0017 or ·002 to 3 places.

(3) 17·435 shillings = ·87175 £.
3·75 half-crowns = ·46875 £.

So that the result of the addition is £4·4905, or ·8981 of £5.

Examples.

(1) Find to 5 decimal places the square of ·00123456.

(2) At what rate per cent. will £500 amount to £590 in 4 years' simple interest?

(3) What is the highest power of ·4321, which is less than ·001?

ALGEBRA COURSE.

Chapters XVIII., XIX., and XX. of Hall and Knight may be read, and for the beginner, say, every third example in the sets found in those chapters.

Solutions to last month's examples.

(1) $x^6 - y^6 = (x^3 - y^3)(x^3 + y^3)$
$= (x - y)(x^2 + xy + y^2)(x + y)(x^2 - xy + y^2)$
$x^9 - y^9 = (x^3)^3 - (y^3)^3$
$= (x^3 - y^3)(x^6 + x^3y^3 + y^6)$
$= (x - y)(x^2 + xy + y^2)(x^6 + x^3y^3 + y^6)$
$x^9 + y^9 = (x + y)(x^2 - xy + y^2)(x^6 + x^3y^3 + y^6)$
$(a - 2b)^2 - (a + 2b)^2 = [(a - 2b) + (a + 2b)][(a - 2b) - (a + 2b)]$
$= (a - 2b + a + 2b)(a - 2b - a - 2b)$
$= (2a)(-4b) = -8ab.$

(2) $x^6 - x^5 - x^4 - x$ should have been $x^6 - x^5 + x^4 - x$;
so that
$x^6 - x^5 + x^4 - x = x^5(x - 1) + x(x^3 - 1)$
$= x^5(x - 1) + x(x - 1)(x^2 + x + 1)$
$= x^5(x - 1) + (x - 1)(x^3 + x^2 + x)$
$= (x - 1)(x^5 + x^3 + x^2 + x)$
and
$x^6 - 1 = (x^3 - 1)(x^3 + 1) = (x - 1)(x^2 + x + 1)(x + 1)(x^2 - x + 1),$
and hence the fraction becomes

$$\frac{(x-1)(x^5+x^3+x^2+x)}{(x-1)(x^2+x+1)(x+1)(x^2-x+1)} = \frac{x(x^4+x^2+x+1)}{(x^2+x+1)(x^3+1)}.$$

(3) $(x - 3y)^3 + (x + 3y)^3 = [(x - 3y) + (x + 3y)]$
$[(x - 3y)^2 - (x - 3y)(x + 3y) + (x + 3y)^2]$
$= 2x(x^2 - 6xy + 9y^2 - x^2 + 9y^2 + x^2 + 6xy + 9y^2)$
$= 2x(x^2 + 27y^2).$

(4) $(a^2 + ab + b^2)(a^2 - ab + b^2).$

Examples.

(1) Find the L.C.M. and H.C.F. of
$x^4 - xy^3$, $x^2 - y^2$, $x^3 - x^2y - xy^2 + y^3$.

(2) Factorize $x^4 - 64$ and $x^4 + 64$.

(3) Write down the square of $2x^2 - 3x + 1$.

(4) Simplify
$$\frac{x^3 - y^3}{x^3 + y^3} \times \frac{x^3 - y^3}{x^3 - x^2y - xy^2 + y^3} \times \frac{x^2 + xy + y^2}{x^4 + x^2y^2 + y^4}.$$

(5) The sum of 2 numbers is 20, and one increased by 7 is double the other increased by 6; find them.

GENERAL ELEMENTARY SCIENCE.

Chapters VI. and VII. of Simmons and Jones, and the examples and questions found in those chapters. This should, of course, be supplemented by some practical work.

Questions.

(1) Compare the distances traversed by a falling body in 1, 2, and 3 seconds respectively.

(2) How has the value of g been found experimentally?

(3) Define the terms poundal, mass of 1 lb., and dyne.

(4) How may the C.G. of a brass plate be experimentally found?

Notes.

Answers to the test papers will be corrected 7d. per paper, post free. The same arrangement can be made for those who wish their translation at sight or their version of the 'Sentences for Practice' corrected. Address: 'Matriculation Course,' c/o Editor *P.T.*

NOTES ON PHYSIOLOGY:

EMBRACING THE SUBJECTS OF THE ADVANCED AND HONOURS STAGES, SCIENCE AND ART DEPARTMENT.

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THE examiners in Physiology desire the students to possess an actual knowlege of the statements they make: that, as far as is possible they should handle and see for themselves the facts of Physiology. Book knowledge and detailed information are valueless, unless accompanied by examination of specimens, by dissections, and by practical work in a properly-equipped physiological laboratory. Particularly is this the case with the Advanced and Honours Stages. The examiners are able to distinguish at once the student who has an actual grasp of the subject, acquired by practical work, from the one who has merely read up a certain text-book, and has written out certain statements, perhaps committed to memory. Knowledge acquired from books only, moreover, is evanescent, and therefore useless for the future. In the advanced stage the student must possess a sound acquaintance with the principal branches of the science. He is not expected to examine or discuss the controversies and speculations which agitate the minds of professors of physiology. In order therefore to pass the examination with credit, the advanced student should join a practical class, which includes the teaching of Histology, Physiological Chemistry, and the subjects of Muscle and Nerve. He should make notes of each experiment, and should make sketches of the principal tissues.

In the teaching of Histology, much knowledge may be learnt by paying attention to the simple tissues in the fresh state. For example, very thin pieces of connective tissue may be taken from the spaces between the muscles of the shoulder in a freshly-killed rabbit: spread out under a cover-slip, and staining solution, as logwood, allowed to pass under the slip for a short time, and afterwards washed away, subsequently mounted in glycerine. Such a process, after some practice, shows the connective tissue cells excellently—especially if the white fibres have been previously dissolved by a little dilute acetic acid. In the same way epithelium, muscle, and tendon, marrow cells, blood corpuscles, liver cells, nerve fibres, may all be studied in the fresh condition under the influence of various stains. Sections of organs may be made, or after the method has been learnt, these may be bought and studied at leisure.

The course of practical chemistry should include the properties of proteids, fats, and carbohydrates. Special attention should be paid to blood serum and plasma, the action of the digestive juices, saliva, gastric juice, pancreatic juice, and bile. The properties of hæmoglobin, the spectra of oxyhæmoglobin, and some of its derivatives should be demonstrated by the student himself. The properties of milk and urine should be practically known. He should manufacture casein and milk-sugar from milk, and should be able to prepare urea and uric acid from urine. At the same time he should learn how the amount of urea is determined. These methods will be mentioned in subsequent notes.

In the physical part, the student should demonstrate the properties of the beat of the frog's heart, and see the influence of stimulating the vagus; he should have a definite idea of the meaning of blood pressure, which may be derived from working models. He should be able to make a muscle-nerve preparation, and to arrange it for electrical stimulation, writing the result on a blackened and revolving cylinder. Tracings of blood-pressure, showing the influence of nerves, should be exhibited and explained to him. The sphygmograph and its action should be demonstrated. The properties of nerves is also essential. For the senses, models are useful.

With regard to text-books, the student will find Kirkes' 'Handbook of Physiology,' edited by Professor Halliburton, 14th edition, published by J. Murray at 14s., most generally useful. If he require special knowledge on the brain and nervous system, he may consult Ferrier's 'Functions of the Brain,' published price about 10s. 6d., or Michael Foster's 'Text-book of Physiology,' Part III., 'The Central Nervous System,' 10s. 6d. (Macmillan). For Experimental Physiology, 'The Essentials of Experimental Physiology,' by T. G. Brodie, price 6s. 6d. (Longmans, Green and Co.), is excellent. In place of Kirkes', Dr. Yeo's 'Manual of Physiology,' 14s., 3rd edition, published by Churchill, may be recommended. Professor Schäfer has published a handy book, 'The Essentials of Histology,' 5th edition (Longmans, price 8s.). In the next paper we shall describe the methods for the examination of milk, urine, and the action of starch and gastric juice.

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

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SPRING EXAMINATION, 1899.

EIGHTH MONTH—NOVEMBER.

WORK TO BE PREPARED.

A.—*English.*

First Year.—'Ode on Spring,' verse 2.

Second Year.—Prepare fully lines 251–286 of 'The Deserted Village.'

Third Year.—1. Learn 20 roots and meanings each week.
2. Prepare lines 240–280, Pope's 'Essay on Man.' Epis. IV.

Notes—(a) *'Ode on Spring.'*

Lines 1 and 2. Adverbial sentence of place mod. *shall sit.*
3 and 4. " " " " "
1. *Where'er* = Conj. adv. subord., joining sentences 3 and 1.
5. Extension of the predicate *shall sit.*
7. This line is an enlargement of *me* in line 6.
8, 9, 10. Supply predicates *it* and *are.* These lines are noun sentences governed by *shall think.* The subjects of each are collective nouns, and *How* in each case is an adverb modifying the succeeding adjective.
The Muse = The inspiring Goddess of Poetry.

General meaning:—I love to take my seat or lie in careless happiness by the side of some river or brook, where the rough and moss-covered beech overhangs the greensward, or the thick branches of the oak provide a deeper shade, and moralise upon the vanity of human pursuits. How useless is the continual and clamorous strife after wealth, how despicable and contemptible are those who most affect superiority, and how poor are those who in the eyes of the world are considered most fortunate.

'The Deserted Village.' General Paraphrase (cont.).

Line 251.—Although they may meet with the derision of the rich and the scorn of the haughty, I must confess that I like these simple inoffensive pleasures of the country peasants more than all the artificial amusement to be derived from the wealth and splendour of society. They are natural, they are the spontaneous and unbounded overflowing of a mind free from care, and excite in their exercise neither envy nor jealousy. But how different are the pleasures of the rich—the long continued round of vain and frivolous show by day, the masquerade or ball by night, attended with all the silly fancies and excesses which superfluous wealth can gratify; the devotees of fashion fatigued with the continual pursuit of bubbles become wearied and bored, and notwithstanding all the costly devices to banish care and melancholy, the question will intrude upon them—'Is this really happiness?'

Line 265.—It is the duty of the philosopher, statesman, and political economist—who cannot be ignorant of this collection of riches by the idle few at the expense of the honest and industrious masses—to consider the question and decide whether all this barren pomp and outside show really indicate a flourishing and happy country. Commerce has undoubtedly increased, rich cargoes of precious metals and costly goods reach us amid the acclamations of those who are blind to the best interests of the country; fortunes are amassed which might satisfy the most avaricious miser, and rich men resort to us from all parts of the world. Yet if the question is considered more closely, it will be seen that all this wealth is merely superfluous; the useful productions of the country do not increase, and if this is not so, there is no real advance. In fact this seeming wealth becomes a serious loss, for where in days gone by villages stood amidst well-cultivated fields and inhabited by healthy and happy peasants, now we find one huge house, the fields taken from the rural population to provide space for stables, kennels, artificial lakes, and extensive parks. The owner wears robes which have cost half the produce of the neighbourhood, and the village has been destroyed possibly because it interfered with his view or from some equally trivial cause.

The useful productions of the country are exported to all parts of the earth; in return we get nothing but luxuries; and any country which is parting with its commodities of practical utility to provide itself with articles which are superfluous and unnecessary is certainly declining in national prosperity.

Notes on Parsing and Analysis, etc.

Line 251. *Let*—Note that this is followed by a noun and an infinitive mood.
254. Supply *it* after *charm; Than* = Comp. Conj.; *gloss* = Nom. to *is dear*, understood.
255. *Where Nature, etc.* Adjectival Sentence to *joys.*
258. Adjectives (not participles) qual. *they.*
263. *E'en* = Adv. of Emphasis mod. the Adverbial Sentence following.
264. *If this be joy* = Noun Sentence gov. by *asks.*
be = Subjunctive Mood.
266. *Increase, decay,* Verbs in the Infinitive Mood.
267. *It* is an Impersonal Pronoun. *To judge . . . land,* enlargement of *it,* in apposition.
271. *E'en.* Adv. of Emphasis mod. *beyond the miser's wish.*
273. *But* = Adv. of Degree mod. 'is a name.'
274. *Same* = Adj. completion of 'leaves.'
275. Supply *is* after *so.*
276. *That* = Subject, *poor* = object.
281. *Where solitary sports are seen.* Adjectival Sentence to *seat.*
284. *the world supplies.* Adjectival Sentence to *luxuries.*
285. *All* = entirely. Adv. mod. *in barren splendour.*
285 and 286. This sentence may be taken as adverbial to those preceding it, or a simple adversative.

'Essay on Man,' Ep. IV. General Paraphrase (cont.).

Line 241.—As far as we are concerned, fame consists in the opinions of our immediate circle of friends. Beyond that it does not affect us in the least, whether it be of a living general or one long since dead; a clever man is but as a feather and the victorious general a scourge; the only man who deserves admiration and respect is one who is honourable in all things. Fame may save a villain's name from the oblivion it deserves, as the judge can drag his body from the grave to pollute the air by its disgusting decay, and there is as much ground for congratulation in the second case as in the first.

Again, it must be clearly understood that what we generally considered as fame, is something altogether outside us, which does not in any way affect the man himself. The man who has a clear conscience and can, on looking back, on his actions honestly say, 'I have done what is right,' derives from it more true happiness than he would from the approbation and acclamation of ignorant multitudes. Self-respect is far more to us than the opinions of others. Hence Marcellus in exile was probably a happier man than Cæsar, applauded and served by a cringing and obsequious senate.

Line 259.—Next let us consider what advantage a man derives from a mind far superior to others in ability and foresight. You, my lord, should be able to speak as to this. The greater the mind, the greater is its recognition of its own weakness and limited capacity, the more clearly do we see the faults and defects of others, and the more keenly do we feel our own. A man with such a mind in any occupation or profession stands by himself, he has no companion who can assist nor any critic who can advise. If he attempts to point out to others great truths of which they are ignorant, or if he produces some great schemes which would benefit his country, he is generally looked upon with suspicion and distrust, and possibly his ideas are too advanced to be understood and appreciated by those who are at a great distance beneath him. Such superiority is a very doubtful blessing, for as it lifts a man above the follies of the world, it also deprives him of its comforts.

Line 269.—Let every sensible man then consider these supposed advantages and sum up for his own satisfaction what benefits they give, and against that balance what they cost. Let him carefully estimate what he would have to resign in order to obtain or enjoy them, and if that does not lead him to a sensible conclusion, and he is still inclined to pine for these supposed blessings, let him further consider the living examples around him. Does he sigh for power and dominion or decorations? Look at Sir Umbra or Sir Billy. Is the possession and accumulation of gold his great ambition? how much satisfaction has it given Gripus and his wife?

(N.B.—Lines 244 to 247 are very obscure and may be taken several ways. Lines 261–268 are particularly fine—better in thought and expression than most of the poem. One has only to look back through the pages of history to see many examples of men who have been in advance of their age, whose ideas (now adopted) were scouted as ridiculous and impossible).

Notes on Parsing and Analysis.

Line 243. Supply *it is* after *beside. Beside* = Adj. to *all.*
244. Supply *to.*
245. Supply *it is.*
246. *or . . . or,* Correlative Conjunctions.
248. *But* = Adv. of Degree mod. *from death.*
251. 'What to oblivion better were resigned.' Noun Sentence, subject of *is* in next line.
252. *on high* = Adverbial Phrase.
258. *Than.* Comparative Conj. Supply 'feels' after *Cæsar.*
260. 'What is it to be wise.' Noun Sentence after *tell. To be wise.* Gerundial Inf. in apposition with *it. Wise.* Adjectival completion of the predicate.
261. *To know, etc.* Gerundial Infin. in apposition with *it.*
But = Adv. of Degree mod. *to know.*
263. Supply *to be* at commencement of line.
267–8. Supply *it is. To view yourself, etc.,* in apposition with *it.*
269. *Then.* Adv. of Reason.
270. *See* gov. the Noun Sentence 'to what they amount.'
271. *To cost.* Verb in Infin. Mood limiting *cost.*
273. Supply *are.*
277. *To sigh.* Verb in Infin. Mood limiting *silly.*
280. *But* = Adv. of Degree mod. *look.*

(Students must write for assistance in any difficulty not cleared up above.)

B.—*Arithmetic.*

First Year.

Boys.—Application of Fractions to Weights and Measures.

Girls.—General Problems and back sets of questions.

Second Year.

Third Year, Boys and Girls.—Continue general practice.

A good text-book will supply a sufficient number of exercises on the various rules. Much care must be bestowed on the method and arrangement. The following are models of a few sums—shewing proper arrangement:—

(*a*) Simplify—

$$\frac{\frac{8}{15}+\frac{9}{23}}{\frac{8}{17}+\frac{7}{16}} \times \frac{\frac{4}{11}+\frac{21}{17}}{\frac{11}{15}\times\frac{17}{19}}$$

$$= \frac{\frac{184+135}{15\times 23}}{\frac{128+119}{17\times 16}} \times \frac{\frac{68+231}{11\times 17}}{\frac{209+255}{15\times 19}}$$

$$= \frac{\frac{319}{15\times 23}}{\frac{247}{17\times 16}} \times \frac{\frac{299}{11\times 17}}{\frac{464}{15\times 19}}$$

$$= \frac{319}{15\times 23} \times \frac{17\times 16}{247} \times \frac{299}{11\times 17} \times \frac{15\times 19}{464}$$

$$= \frac{29\times 11}{15\times 23} \times \frac{17\times {}^{1}6}{13\times 19} \times \frac{23\times 13}{11\times 17} \times \frac{15\times 19}{29\times 16} = \text{Ans. } 1.$$

(*b*) What is the least number by which 2268 must be multiplied to make a perfect square.

2268 in prime factors $= 2 \times 2 \times 9 \times 7$
$= 2^2 \times 9^2 \times 7.$

Therefore to obtain a perfect square it will be necessary to multiply by 7. Ans. 7.

(*c*) Reduce 4·32428571 to a vulgar fraction.

·428571 = $\frac{3}{7}$. Therefore the fractional part is equal to

·32$\frac{3}{7}$ or $\frac{32\frac{3}{7}}{100}$ or $\frac{227}{700}$. Ans. $4\frac{227}{700}$.

(*d*) A number is divided by 45 in two steps, the factors being 5 and 9, and the remainders are respectively 3 and 5. What would the remainder have been if the number had been divided by 9 and then by 5?

$45 \begin{cases} 5) \\ 9) \\ \end{cases} \begin{matrix} \\ \\ \end{matrix} \begin{matrix} \\ +3 \\ +5 \end{matrix}$ 28 full remainder.

If the order of the factors be reversed we get

$45 \begin{cases} 9) \\ 5) \\ \end{cases} \begin{matrix} \\ \\ \end{matrix} \begin{matrix} \\ + \\ + \end{matrix}$ 28. Hence it is seen that 28 must be made up of as many 9's as possible + remaining units = 3 + 1. Hence remainders = 1 and 3. Ans.

(*e*) A bought a bicycle for £10 and sold it to B at a gain of 10%, B sold it to C at a gain of 10%. How much did C pay?

Let 100 = cost price to A.
Then 110 = price B paid,
and 110 + ($\frac{1}{10}$ of 110) or 121 = price C paid.
Then selling price of 100 = 121
" " $1 = \frac{121}{100}$
" " $10 = \frac{121 \times 10}{100} = £12{\cdot}1$ or £12 2s. Ans.

C.—*Geography.*

Siberia, China, and Japan.—The geography of these countries is important, and especially so at the present time. The productions, industries, commerce, and government require especial attention. The Trans-Siberian Railway, the Corea, Port Arthur, Wei-hai-wei, etc., must be noted. The rapid development of Japan into a powerful Empire, and the causes of this progress should be known.

D.—*History.*

The Commonwealth and Charles II.—Note the spirited Foreign policy of Cromwell and its effects, and the causes which led to the downfall of the Republican Government. The character of Charles. The treaty of Dover; the Test Act; the Dutch Wars; the Great Plague and Great Fire; Titus Oates' plot, etc. Read if you can some of Pepys' Diary to get an insight into the social and political life of the times. The Clarendon Code of Laws against Nonconformists should also be noted.

E.—*Euclid.*

Second Year.—Props. 25, 26, Book I. and four deductions per week.
Third Year.—Props. 15–21, Book I. and six deductions per week.

G.—*Algebra.*

General exercises on the whole year's work. See note under Scholarship for hints on Mensuration.

H.—*Teaching.*

Second Year.—Read up what is said in Instructions to H.M. Inspectors on elementary subjects.
Third Year.—Revise chapters iv.–vi., 'Scholarship School Management.'

Test Questions.

1. *Penmanship.*
Largehand:—Euphrosyne.
Smallhand:—An honest man 's the noblest work of God.
2. Write an essay on the Electric Telegraph.
3. Paraphrase and analyse all the English set, and parse all words presenting difficulty.
4. *First Year.*—Name the intervals
d–l, r–t, t_1–f, m–t
Second Year.—Write the following in two pulse measure, in the same number of measures:—

| d :— :d | d :— :— | d :d :d | d :— :d |
| d :d :— | d : :d ‖

Third Year.—Which of the following is highest in pitch and which is lowest:—
l in key C, m in key B♭, s in key G, r^1 in key D.

5. Describe with a sketch map the course of the Ganges. Why does it rise in May and June?
6. Describe the Indian Seasons.
7. Give some account of the government of India, and mention any Native States not directly subject to the British Government.
8. What do you know of the Productions of India? What are the chief exports? Which of the latter have recently increased?
9. What do you know of Delhi, Benares, Cawnpore, Punjaub, Simla, Point de Galle, Agra, Goa, Lucknow, Hooghly, Deccan, Bangalore, Rangoon, Trincomalee, Lahore, Calicut, Kurrachee, Singapore, Surat?
10. Recount in order, with dates, the chief incidents of the War between Charles I. and the Parliament.
11. Under what circumstances did the Scots take part in the Civil War?
12. What do you know of the 'Humble Petition and Advice'?
13. Explain clearly how you would lead children to see the real remainder when dividing by 3 factors. Take for example division by 7, 8, and 9, with remainders 5, 4, 7.
14. Write notes of a lesson on the Pig, or on Comparison of Adjectives.

AUTUMN EXAMINATION, 1899.

SECOND MONTH—NOVEMBER.

WORK TO BE PREPARED.

A.—*English.*

First Year.—Prepare fully lines 29–48 of 'The Bard.'
Second Year.—Prepare fully lines 51–96 of 'The Deserted Village.'
Third Year.—(1) Learn 20 roots and meanings per week.
(2) Prepare fully lines 41–79 of Pope's 'Essay on Man,' Ep. IV. Pay great attention to the paraphrases.
(For full notes on Parsing, Analysis, and Paraphrase, see June Number.)

B.—*Arithmetic.*

First Year.—Boys.—Complex and Continued Fractions.
Girls.—Simple Practice.
Second Year.—Boys.—Compound Proportion.
Girls.—Compound and Complex Fractions.
Third Year.—Boys.—Cube Root. Study reason of rule; as in Square Root compare method with algebraic.
Girls.—Recurring Decimals. Pay great attention to the theory.
(N.B.—The decimals produced by reducing any *seventh* to decimals should be noted. The figures are the same, in the same order, but starting at a different place.

$\frac{1}{7} = ·142857$ $\frac{2}{7} = ·285714$ $\frac{3}{7} = ·428571$
$\frac{4}{7} = ·571428$ $\frac{5}{7} = ·714285$ $\frac{6}{7} = ·857142$

These continually occur in questions set.)

C.—*Music.*

First Year.—Standard Scale of Pitch and Mental Effects.
Second Year.—Continue practice in Transition.
Third Year.—Names of Chromatic Notes and Chromatic Intervals.

D.—*Geography.*

Europe.—Climate, Productions, Peoples, Religions, &c.
France, completely. Use note books and sketch maps continually.

E.—*History.*

Henry IV., Henry V., and Henry VI., up to the Wars of the Roses.
Chief points:—
Henry's right to the Throne and how it affected his relations with Parliament.
The various insurrections against him.
The persecution of the Lollards.
Henry V. War with France: Cause, Course, Results.
Henry VI. Minority. Loss of French Possessions, Joan of Arc. Dispute for power and causes of the Wars of the Roses.

F.—*Euclid.*

Second Year.—Props. 1–4, Book I.
Third Year.—Props. 32–36, Book I., and four deductions per week.

G.—*Algebra.*

Multiplication and Division.

H.—*Teaching.*

Prepare notes of Lessons weekly.
Second Year.—Chap. III., 'Scholarship School Management.'
Third Year.—The Teaching of Geography.

Test Questions.

1. *Penmanship.*
Largehand :—Dynastical, Efflorescence, Faithfulness.
Smallhand :—What happiness we call,
Consists not in the good of one, but all.

2. *Composition.*— Write an essay each week on such subjects as :—The British Empire, Temperance, The Choice of Books, War, Sleep, What is Education?

3. *English.*—Analyse and paraphrase the passages set for preparation, and parse any words presenting difficulty.

First Year.—Give the meaning of the suffixes in the following—Braggart, kingdom, godhead, kindred, webster, steward, landscape, manifold, tearless, homeward, nowise, cleanse, height, wrinkle.

Second Year.—Give the meaning of the prefixes in the following :—Ambiguous, bifurcate, collide, countermine, distil, enquire, equiangular, interpellate, mischief, pellucid, triangle, viceroy.

Third Year.—Give some rules by which you would distinguish words of Teutonic origin from those of classical origin.

4. *First Year.*—Name the intervals :—

$\{t\ n\}$ $\{r'\ s\}$ $\{d\ t_1\}$ $\{d\ n\}$ $\{s\ l_1\}$ $\{t\ f\}$ $\{l\ r\}$

Second Year.—Rewrite the following on the imperfect method :—

d n r l ^{s}d t$_1$ r f n d s n r f n$_1$ l$_1$ t$_1$ ^{d}s n d

Third Year.—Write and explain the three forms of the minor scale.

5. Give some account of the mountain system of Europe.
6. Enumerate the chief features of the coast passed in a voyage from Hamburg to Constantinople.
7. Where and what are the following :—Neckar, Sulitelma, Stromboli, Yenikale, Lombardy, Iviça, Corfu, St. Gothard, Ladoga?
8. Describe, with a plan, the Battle of Bannockburn.
9. Give some account of the Judicial Reforms in the reign of Edward III.
10. Explain clearly what causes brought about the Peasants' Revolt. What were the chief results?
11. Explain Edward's claim to the French throne. Give your ideas as to its justice.
12. What do you understand by the term School Management?
13. How can the memory be developed?
14. (Third Year). Of what value is English as a means of mental training. Sketch the plan of a first lesson in Analysis.

SCHOLARSHIP COURSE FOR DECEMBER, 1898.

1. *Penmanship.*—Ten minutes' daily practice *from a good model.*
2. *Composition.*—Write one or two essays per week, selecting from the following :—
(*a*) Imitation is the sincerest flattery.
(*b*) Temperance and Teetotalism—their comparative advantages.
(*c*) The Post Office.
(*d*) The pleasures and perils of the sea.
(*e*) Angling.
(*f*) 'Neither a borrower nor a lender be.'
(*g*) The choice of a friend.
(*h*) Reasons for kindness to animals.

3. *English.*—(1) Learn 20 roots and meanings per week.
(2) Revise all definitions and the syntax of the noun, pronoun, and verb.
(3) Revise the literature to 1600, paying special attention to—
(*a*) The changes produced by the Norman Conquest.
(*b*) The influence of Printing.
(*c*) The Renaissance and its effects.

4. *Arithmetic.*—Work any general papers and problems, such as problems on Motion, problems on Clocks, problems on the work of mixed agents.
Pay great attention to method and arrangement.

5. *Algebra and Euclid.*—Revise anything not thoroughly known. Practise answering against time.

6. *Mensuration.*—The following is a summary of the formulæ and facts necessary for the examination :—

(1) *Right-angled Triangles.*—

$$\text{Area} = \frac{\text{Base} \times \text{Height}}{2}.$$

Square on the hypotenuse = sum of the squares on the sides. From this either side can be found when the other two are given.

(2) *Triangles.*—

$$\text{Area} = \frac{\text{Base} \times \text{Height}}{2},$$

or where height is not given, area $= \sqrt{s(s-a)(s-b)(s-c)}$, where s is half the sum of the sides, and a, b, and c the three sides.

E.g., Find the area of a triangle with sides 105, 116, 143.

105 / 116 / 143 / 2|364 / 182 = s

182 / 105 / 77 = $(s-a)$

182 / 116 / 66 = $(s-b)$

182 / 143 / 39 = $(s-c)$

$$\text{area} = \sqrt{182 \times 77 \times 66 \times 39}$$
$$= \sqrt{13 \times 14 \times 11 \times 7 \times 11 \times 6 \times 13 \times 3}$$
$$= \sqrt{13^2 \times 7^2 \times 11^2 \times 6^2}$$
$$= 13 \times 7 \times 11 \times 6 = \underline{6006}. \quad \text{Ans.}$$

(N.B.—It is often possible to extract square root by factors without multiplying up and taking the square root).

(3) *Circle.*—Circumference $= 2\pi r$ ($\pi = \frac{22}{7}$, r = radius).
Area $= \pi r^2$.

E.g. (*a*) Diameter = 4 ft. 8 in. Find circumference.
Circumference $= 2\pi r$
$= 56 \times \frac{22}{7} = \underline{176 \text{ in.}}$ Ans.

(*b*) Area of circle = 100 sq. feet. Find radius.
By formula, area $= \pi r^2$.
$\therefore$ 100 sq. ft. $= \frac{22}{7} r^2$
$r^2 = 100 \div \frac{22}{7}$
$r = \sqrt{100 \times \frac{7}{22}} = \underline{5{\cdot}64 \text{ feet}}$.

To find area of circular ring.
Let R = radius of larger circle and r radius of smaller circle.
Area of larger circle $= \pi R^2$ and of smaller $= \pi r^2$.

$\therefore$ the difference = area of ring $= \pi R^2 - \pi r^2$
or $\pi (R^2 - r^2)$,
or $\pi (R + r)(R - r)$.

That is, multiply the sum of the radii by their difference and the result by $\frac{22}{7}$.

(4) *Rectangle.*—Area = Height × Base.

Questions are often asked to find the area of a path round the rectangle. In all cases draw a figure. Find area of larger rectangle and subtract area of smaller.

Thus : A path 6 feet wide is made round the inside of a rectangular court 50 feet by 60 feet. Find its area.

Area of court $= 50 \times 60$, area of smaller rectangle $= 38 \times 48$.
Therefore area of path $= (50 \times 60) - (38 \times 48)$.

(5) *Parallelograms.*—Area = Height × Base.
If either of these dimensions is not available, it is often possible to divide the figure into *two* triangles whose area can be found.

Hints on Solution of a few Typical Problems.

(1) Find the area of a square whose diagonal is 9 chains 57 links.
(The square on the diagonal = twice the square. Therefore square the diagonal and divide by 2.)
Ans. 4 ac. 5 sq. ch. 7924·5 s.l.

(2) A floor is half as long again as it is broad, and contains 13,824 sq. ft. Find the length of the sides.
(Two-thirds of the figure would be a square. Hence
$\sqrt{\frac{2}{3}}$ of 13,824 = shorter side.
Ans. 96 and 144.

(3) The sides of a triangle are in the ratio 13, 13, 10. If its area be 3,840 sq. yds., find the length of sides.

By formula, area $= \sqrt{s(s-a)(s-b)(s-c)}$
$3{,}840 = \sqrt{18x(5x)(5x)(8x)}$
$= \sqrt{(5x)^2(12x)^2}$
$= 60x^2$.
$x^2 = \frac{3840}{60} = 64$.
$x = 8$.
Sides $= 13 \times 8,\ 13 \times 8,\ 10 \times 8$
$= \underline{104,\ 104,\ 80}$.

(4) The area of a circle is 38·5 sq. ft. Find the side of a square whose perimeter = circumference of circle.

By formula, area $= \pi r^2$,

$$38{\cdot}5 = \frac{22}{7} r^2,$$

$$r^2 = \frac{3{\cdot}5}{38{\cdot}5} \times \frac{7}{22} = \frac{24{\cdot}5}{2} = \frac{49}{4},$$

$$r = \sqrt{\frac{49}{4}} = \frac{7}{2} = 3\tfrac{1}{2}.$$

$\therefore$ Diameter $= 7$ feet.

Circumference $= 2\pi r = 2\frac{2}{7} \times \frac{7}{2} = 22$.

Hence side of square $= \frac{22}{4} = 5\frac{1}{2}$ feet. Ans. $5\frac{1}{2}$ ft.

(5) Show that the area of a triangle whose sides are in the ratio 3 : 3 : 4 is greater than $\frac{1}{5}$ of the area of the square on one of the shorter sides.

By formula, area $= \sqrt{s(s-a)(s-b)(s-c)}$
$= \sqrt{5(2)(2)(1)}$
$= \sqrt{20}$
$= 4{\cdot}4+$

$\frac{1}{5}$ of $3^2 = 4$.

$\therefore$ $4{\cdot}4 > 4$. Ans.

7. *Geography*—(1) Revise British Isles.
(2) Revise Central and South America.
(3) Practise memory maps.

In addition to this it would be well to tabulate the imports and exports of the United Kingdom, whence they come and whence they go. The interchange of production is an important part of the geography.

Make absolutely sure of the memory maps.

Notes (by request). The British Occupation of Egypt.

It is interesting and useful at this juncture to trace the causes and incidents which have led to the present state of affairs in Egypt and the Soudan.

In 1811, Mehemet Ali, Governor of Egypt, revolted against the Sultan and made himself independent, and extended the domination of Egypt nearly to the Great Lakes.

In 1866, Ismail Pasha, grandson of the above, was appointed Khedive, and the succession made hereditary on condition of an annual tribute to the Sultan.

Under the rule of Ismail, Egypt became nearly bankrupt, taxes were levied and collected with the usual Turkish injustice; commerce, trade, manufactures, and agriculture steadily decreased. In 1876, the British Government bought for four million pounds (⅓ of the whole value) the Khedive's share in the Suez Canal, and in 1879 the foreign powers interfered to protect their capital and interests in Egypt, and Ismail retired on a pension and was succeeded by his son Mohammed Tewfik. From 1879 to 1883 there were two Controllers-General (one English and one French). In 1882 a formidable rebellion under Arabi Pasha broke out, and as France declined to assist in its repression, the work was undertaken by the English alone, and after the bombardment of Alexandra and the short campaign ending with the battle of Tel el Kebir, order was restored, Arabi banished, the Dual Control abolished, and England occupied the country alone and controlled its finance. Under our rule a total revolution in the position of Egypt has taken place. The finances have been carefully controlled, the Civil Law revised and properly executed, the taxation made even in its incidence, a native army has been formed and equipped, and the whole country is becoming rich and prosperous. This, however, only applies to Lower Egypt. Up till 1882 the rule of the Khedive extended over all the countries of the Upper Nile Basin, but in that year a rebellion of the Arab Dervishes under the Mahdi broke out, which cut the Upper provinces off from Lower Egypt. Emin Pasha, Governor of Equatoria, was rescued from the south by Stanley. General Gordon hastened to Khartoum and held it. An expedition was, after hesitation and delay, hurriedly sent out from England, but before Khartoum was reached the town had been stormed and Gordon killed, 1885. The effective rule of Egypt was afterwards limited to Wady Halfa and the rich province of the Lower Nile, while Khartoum, the key of the Eastern Soudan, remained in the hands of the Moslem fanatics. The hideous slave trade, which Gordon had checked, revived, and the development of civilisation received a decided reverse. The Mahdi died and was succeeded by the Khalifa, a new town of Omdurman sprung up on the left bank of the Nile opposite to Khartoum. Meanwhile the Administration was not idle. Some useful lessons had been learnt from the '83 campaign. The necessity for means of transport for a native army and careful preparation for the Arab 'rushes' was fully recognised and acted upon. Under Major (afterwards Sir H. Kitchener) advance was slowly but steadily made. A native army was raised and made efficient, a fleet of light steamers provided, a railway made from Korosko to Abu Hammed and continued to Berber, telegraph communication laid as the army advanced, and progressing slowly but with absolute certainty the expedition this autumn reached Omdurman. The Dervishes were defeated with terrible slaughter, Omdurman and Khartoum taken, the Khalifa's power entirely broken and his forces dissipated, and rule and order substituted for religious fanaticism. The organisation and conduct of the whole campaign reflects the highest credit on the Sirdar and the English officers who worked with him.

Subsequently the Sirdar proceeded by boat to Fashoda, where he found a handful of Frenchmen and some native troops under Major Marchand, who had reached that place from French Congo, thanks to the attention of the Khalifa being occupied by the British advance.

The sway of the Egyptian Government will undoubtedly be extended as far as the Great Lakes and the Soudan and thus opened to civilization and European trade, the slave trade will receive a great check, another step taken to place under the light of reason what has been one of the darkest districts of Dark Africa.

8. *History*—George I., II., and III. up to 1800.

9. *Domestic Economy*—Finish completely.

10. *Music*—Chap. 10 and 11, 'School Music Teacher.'

11. *French*—Chap. 10 and 11, 'Philosophe sous les Toits'.

TEST EXAMINATION.

For the convenience of students we give this month a test examination. The times allowed, marks, number of questions, and questions to be answered are exactly the same as the latest examinations. If any student so desires, the paper will be marked, criticised, and returned, if sent to Mr. A. T. Flux, The Bays, Belvedere, Kent, with a postal order for 3s. 6d.

Penmanship and Dictation.

Time allowed half-an-hour. [Marks: Pen. = 60, Dict. = 50].

Write in largehand as a specimen of penmanship—

Venus Aphrodite.

Write in smallhand as a specimen of penmanship—

Uprose the King of Men with speed,
And saddled straight his coal-black steed.

Dictation.

The passages should be read *once* distinctly and then dictated *once* in portions as marked. Full stops only should be given.

The disinclination | at the present time | to read anything | requiring even a momentary study | is a striking | and melancholy characteristic | of the present generation. | We peruse newspapers, | novels, gazettes and magazines | with the greatest avidity | while we are repulsed | by the very opening | of a volume | on such a subject | as political economy | Logic | or ecclesiastical history. | And while we can with assiduity | for hours pore over | the latest work of fiction | of the most mediocre kind | we listen almost impatiently | to the explanation | of what is a promissory note | a bill of exchange | or a logical syllogism | in an argument. | When such erroneous | and necessarily superficial knowledge | becomes stereotyped | as it were | on our memory | we are incapable of imparting | any valuable information | to others | and our empirical formulas | are received | by those better informed | with some amount of suspicion | .

Another distinguishing quality | of the information of the present day | is its want of discrimination | and accuracy. | We usually obtain information | about things | in such an unsatisfactory manner | , accompanied by much inattention | on our own part | that instead of well digested | and important truths | we have merely | vague and confused ideas | possessing strictly speaking no value. | And when we try | to communicate our ideas to others | we do so | at the expense of truth itself | and the risk of losing | our character for intelligence.

Composition. 1 hour. (Marks, 60.)

Write a short composition on *one* of the following :—

(*a*) The British Occupation of Egypt, its responsibilities and advantages.

(*b*) 'The old order changeth, yielding place to new.'

(*c*) The migration of birds and animals.

English. 2½ hours. (Marks, 100.)

All candidates *must* answer Question 1, to which the highest marks are assigned, and may select *five*, and five only, of the rest.

No abbreviation of less than 3 letters is to be used in parsing or analysis.

1. Analyse and parse words in italics :—

I *do* not, Brother,
Infer *as if* I thought my sister's state
Secure, without all doubt or controversy;
Yet where an equal poise of hope and fear
Does arbitrate the event, my nature is
That I incline to hope, *rather* than fear,
And gladly banish squint suspicion.
My sister is not so *defenceless* left
As you imagine; she has a hidden strength
Which you remember not.

2. Make a list of the Latin and English prefixes and suffixes in the above, and explain the meaning and effect.

3. Explain the meaning of each of these terms and make sentences containing illustrations: Passive, Antithesis, Co-ordinate, Apposition, Infinitive of Purpose, Ellipsis.

4. Give and explain all the uses you know of the Nominative and Objective cases.

5. What is meant by Comparison of Adjectives? What classes of Adjectives do not admit of comparison, and why? What is the difference in meaning between farther and further, older and elder, later and latter.

6. What is the Subjunctive Mood? Explain clearly the difference between it and the conditional use of the Indicative.

7. Give 10 familiar quotations (not more than *two* from any one writer), and say, if you can, the author and the work from which taken.

8. Mention the chief works of 6 of the following and the century in which they lived: Swift, Wordsworth, Dryden, Chaucer, Dickens, Defoe, Jonson, Milton.

9. Explain as fully as you can the effect of (*a*) the Norman Conquest on the Anglo-Saxon Language, or (*b*) the revival of Learning.

Arithmetic. 2½ hours. (Marks, 100.)

Candidates must answer *three*, and three only, of the questions under Section I., to which the highest marks are assigned, and may answer *ten* others.

More marks are assigned to the questions in Section III. than to those in Section II.

The solutions must be given at such length as to be intelligible to the examiner.

SECTION I.

1. (*a*) A number is divided by 336 by factors 6, 7, and 8, and the remainders are 5, 6, and 7. How would you show a class how to find the real remainder?

(*b*) If the number had been divided by the factors in order 8, 7, and 6, what would the remainder from each line have been?

(*c*) If the total remainder were 297, what would the remainders in each line have been if divided in the order 7, 6, 8?

2. State the rule for dividing one fraction by another, *e.g.*, $\frac{5}{6} \div \frac{3}{4}$, and explain your method as to a class by diagram or otherwise.

3. (*a*) Is there anything incorrect in the proportion—

As 3 books : 4s. 0d. : : 5 books : 7s. 6d.?

(*b*) Is it necessary that the unknown term in a proportion should always be in the fourth place?

(*c*) What is the duplicate ratio of 2 : 3 and the compound ratio of 3 : 4, 5 : 6, 8 : 5.

4. Define Least Common Multiple, Proportion, Average, Discount, Brokerage.

SECTION II.

5. Find the greatest number which will divide 13956 and 14565 and leave a remainder of 7 in each case.

6. How many inches are there in 15 times 1 mile 2 furlongs 11 poles?

7. From $15\frac{9}{17}$ take $14\frac{14}{15}$.

8. Simplify $\dfrac{5\frac{5}{12} - 2\frac{1}{8}}{3\frac{3}{4} + 1\frac{9}{16}}$ of $\dfrac{4\frac{1}{2} + 15\frac{3}{8}}{4\frac{3}{16}}$.

9. Reduce ·35 of 10s. + ·54189 of 12s. 4d. + ·238 of 15s. 6d. to the decimal of £1 6s. 3·8d.

10. A has a field of 15 acres and B one of 27. They have a man to assist them in ploughing the whole. They work together, and the man's wages amount to two guineas. How much should each pay?

11. In what time will £225 amount to £256 10s. at 4 per cent.?

12. Find the square root of 1127·6164.

SECTION III.

13. If 15 men do a piece of work in $12\frac{2}{3}$ days of $9\frac{1}{2}$ hours each, how many days of 11 hours each would 9 men require to do $4\frac{1}{2}$ times the amount?

14. Find to the nearest penny the amount of £4324 in 2 years at 5 per cent., compound interest.

15. Find the least number by which 10584 must be multiplied to make a perfect cube.

16. A person sells £5,000 3 per cent. stock and buys $3\frac{1}{2}$ per cents. at $87\frac{1}{2}$. If the increase in his income be £5, what is the price of the 3 per cents.?

17. A and B can do a certain task in 30 days working together. After 11 days however B is called away, and A finishes it by himself 38 days after. In what time could each do the whole?

18. A bought a horse which he sold to B and gained 5 per cent. B sold it to C and gained $16\frac{2}{3}$ per cent. C gave 140 guineas for it. What price did A give?

Alternative Questions in Algebra.

Any of these questions may be answered instead of the same number of questions in Sections II. and III. above. They are more highly marked than the Arithmetic.

1. Prove the rule for subtracting algebraical quantities, and simplify

(1) $a - (3b - 2c) - \{4c - (3b - a)\}$.

(2) $(a + 1)(a + 2)(a + 3) - (a - 1)(a - 2)(a - 3)$.

2. Simplify

(1) $(3a - 2b + c)^2 - (a - 2b + 3c)^2$;

(2) $(a + b)^2 - (a + b)(a - b) - [a(2b - a) - b(2a - b)]$.

3. Divide $4x^4y^4 + 1$ by $2x^2y^2 - 2xy + 1$, and find the value of the quotient when $x = -2$, $y = 3$.

4. Find two numbers whose ratio is 7 to 6, and whose sum is 299.

5. Solve the equations

(1) $7(x - 6) - 4(13 - x) + 9(2x - 2) = 36$.

(2) $\dfrac{2x - 7}{15} - \dfrac{3x - 8}{5} + \dfrac{x - 2}{3} + 1 = 0$;

(3) $\dfrac{x - 7}{11} - \dfrac{3x - 5}{7} + \dfrac{125}{77} = 2x - 17$.

6. A certain party is composed of twice as many men as women, when 6 men have left together with their wives, there remain three times as many men as women. How many were there of each sex at first?

School Management. 2 hours. (Marks, 100.)

All candidates must answer Questions 1 and 2, and not more than *five* other questions.

1. Write notes of a lesson on Least Common Multiple, the Baltic Sea, Comparison of Adjectives, the Thermometer, the Polar Bear.

2. What explanations would you give to children reading the following extract :—

> 'Had New England been colonised immediately on the discovery of the American Continent, the old English institutions would have been blended with the Roman Catholic hierarchy; had the settlement been made under Elizabeth, it would have been before activity of the popular mind in religion had conducted to a corresponding activity of mind in politics. The Pilgrim Fathers were Englishmen, Protestants, exiles from conscience, and men disciplined by misfortune.'

3. What are the characteristics of good writing? What kind of copy-books would you use in an Upper Standard?

4. 'Some school subjects are taught for their practical utility, others for the mental training they afford.' Explain and illustrate this.

5. Point out the advantages of a decimal system of money, weights, and measures. Why is it not adopted in England?

6. What are the chief requisites of a School Reading-Book?

7. Describe some form of Physical Exercise with which you are acquainted, and point out the benefits to be derived from such exercises.

8. Why should infants have shorter lessons than older children?

9. What are the habits a child would acquire while attending a good school?

10. Draw out a syllabus for the first quarter of the year for Standard V., OR, Class I., Infants.

11. What common mistakes do children make in Composition? How do they arise? How would you correct them?

12. What kind of rewards should be given to children? Discuss the propriety of giving money prizes.

Music. ¾ Hour. (Marks, 20.)

(Answer *five* questions.)

1. Write plainly the following values in three-pulse measures. The figures show duration in pulses or fractions of a pulse. Begin on a strong pulse :—

¾	½	⅓	½	1	3	1½	½	⅓	½	⅓	½	⅓	1	1
s	m	f	REST	m	d'	r	f	l	REST	t_1	s	f	r	m

2. Name the following intervals :—

s—m', d—f, m—r, fe—d', f—s, se—d', f—ta, m—fe

3. Re-write the following passages, making in (1) a transition to the first sharp key at (*a*) and a return at (*b*) :—

(*a*) (*b*)

(1) m s f l m fe l s d' m l fe r s d m f r d

and in (2) a transition to the first flat key at (*a*) and a return at (*b*).

(*a*) (*b*)

(2) m s d' s l ta l m' r' ta s m f l s d' t r' d'

4. Write the minor scale (*lah* mode) using the major 6th and major 7th in ascending and the major 7th and minor 6th in descending.

5. Which of the following notes is highest in pitch and which is lowest :—

t in key C, m_1 in key A, s in key B♭, f_1 in key G, l in key G, s in key F, s_1 in key E♭.

6. Explain briefly the following terms : Adagio, Forte, Crescendo, Andante, Sostenuto.

The remaining papers will be given in next month's issue.

PRIZE WINNERS IN THE QUARTERLY TEST EXAMINATION.

A prize of One Guinea is awarded to Millicent Andrews, St. Augustine's School, Rugely, Staffordshire, for the best papers in the Spring Examination; and to T. Gregory, Glaes Board School, Clydach R.S.O., Glamorgan, for the best papers in the Autumn Examination.

ANSWERS TO CORRESPONDENTS.

N.B.—Students writing *must* comply with regard to enclosure of coupon and stamped addressed envelope if direct reply is required.

Constance Rees.—Unable to return your work. No address enclosed.

B. T.—Text Books will be fully dealt with in January number, 1899. Geography, Meiklejohn's and Gill's 'Colonies': Domestic Economy, Newsholme and Scott's; Theory of Teaching, 'Scholarship School Management.'

Discipulus.—Essay 50/60. Style rather crude. Many facts mentioned might well be omitted. Writing 45/60. Small, irregular, and unevenly spaced.

Copernicus.—Essay 55/60. Penmanship 55/60. Both considerable improvements.

W. A. W.—Writing 50/60. Essays 50/60 and 55/60.

Olivia.—Essay 45/60. Too much like a catalogue. An essay should be as far as possible original thought. Penmanship 48/60. Too stiff in style.

Loftus.—Penmanship 45/60. Lack of firmness. You must avoid backward slope.

Stoic.—Essay 50/60. Ideas good, but language poor. Avoid slang, and do not endeavour to emphasize your points by cheap smartness.

A. E. T.—Penmanship 55/60. Essay 55/60. 79 A.D., Eruption of Vesuvius.

A. A.—Map 25/30. More names needed. Writing 50/60. Essay 50/60.

Hispano.—Map 20/30. Writing poor. Neater finish required. Penmanship 48/60. Smallhand irregular.

Godwin.—Paraphrase 9/10. Parsing 8/10. *Mine* = Nom. after *is*. Distinguish *my* and *mine*, *your* and *yours*, etc. Essay 56/60. Very good. A few sentences awkwardly written.

All other correspondents answered by post.

OUR NEW CERTIFICATE COURSE FOR 1899.

By GEORGE COLLAR, B.A., B.Sc.,
Headmaster of the Stockwell Pupil-teacher School.

Questions on the October work are unavoidably held over till next month.

SYLLABUS FOR NOVEMBER.

Theory of Teaching.

First Year.—Methods of teaching writing, including dictation.

Materials—Slates: advantages, cheapness and durability; disadvantages, untidiness of work owing to impossibility of keeping a fine point, sameness of strokes in all directions, trouble of cleaning slates. [N.B.—Slate-cleaning is *not* one of the uses of saliva mentioned in the physiology books].

Paper: leads children to feel responsibility for neatness from the first.

Mulhauser's Method. The first attempts at analysis and synthesis of the letters. Elements of the letters, right line, hook, curve, loop, crotchet, besides the bar and dot. Height of letters, spacing. Classification of the letters according to the elements from which they are formed.

Size of writing: use of large or text-hand. Headline copy-books, their advantage and disadvantages. Moveable copy-slips.

Features of good writing: legibility, rapidity, beauty.

Slope: From 60° to 90°. Advantages and disadvantages of vertical writing. Semi-upright.

Dictation: its connection with spelling on the one hand and writing on the other. Difference between a dictation *test* and a dictation *lesson*.

Logic.—Jevons, Ch. VII., VIII. Very close attention must be paid to Ch. VIII. on the 'Kinds of Propositions.'

Second Year.—1. Psychology. Structure and function of nerves; afferent and efferent nerves. The spinal cord, arrangement of the grey and white matter. Reflex action.

The brain: (*a*) *Medulla oblongata:* an expansion of the cord within the skull. Similar in structure and functions to the spinal cord. Higher reflex actions.

(*b*) *Cerebellum:* its structure; its function, to co-ordinate movements. Dexterity dependent upon it. Importance of the power of combining several simple movements into one complex act.

(*c*) *Cerebrum:* seat of the intellect, the feelings, and the will. The chief 'centres,' *e.g.*, the motor centres by the fissure of Rolando.

Nerve cells and their action, its cause and its outlet.

The three-fold division of the action of mind. Feeling, intellect, and will; their inter-dependence.

Mental development, its stages. Comparison between minds more or less completely developed. Effect of heredity and environment on the development of the mind. What can, and what cannot, be done by the teacher.

2. School hygiene. Seats and desks; correct proportions, slope. Effects of sitting in ill-proportioned desks.

Ventilation. Composition of air. Respiration, its effect on the human body, and on the air. Effect of breathing unrenewed air, feverishness, and depression of mental activity. Moisture in the air. Effect of raising the temperature without increasing the amount of moisture in the air. Dust and floating particles. The mechanical principles of ventilation.

English Composition.

1. Write an essay on 'A visit to a Cathedral.' (Serious Style.)
2. Write a letter to a provincial School Board, applying for a post as assistant teacher. (Business style.)
3. Describe a journey from London to Paris, with three children, four large trunks, and a dog. (Humourous style.)

Arithmetic.

Definitions of factors, multiples, roots and powers. Prime and composite numbers. Tests of divisibility with proofs. Proof of sums in the four simple rules by casting out the nines. Resolution of numbers into factors. Number of divisors of a number. Common divisors, common measures, or common factors, highest common factor. Method of finding the H.C.F. (or G.C.M.) of two or more numbers from their prime factors. Ordinary rule, the three methods of shortening the work, (*a*) by taking out common factors to form part of the result; (*b*) by taking out and neglecting factors that are not common; (*c*) by a good arrangement of the work, including Italian method of division.

Determination of the square (or cube) root of a number which is an exact square (or cube) from its prime factors.

Multiples, common multiples, least common multiple. Determination of the L.C.M. of two or more numbers from their prime factors; general arrangement of the work.

Chapters XVII., XVIII., XIX. the 'New Arithmetic' in Prof. Meiklejohn's series should be carefully studied, and all the examples worked. The questions on theory of numbers will be found particularly valuable.

Theory of Music.

Diatonic intervals. Named from the number of notes passed (including the lower one) in going from the lower to the higher note. Two varieties of each interval to be found:—Major second (one tone) and minor second (one semi-tone), major third (two tones) and minor third (one tone and one semi tone). Pluperfect or augmented fourth (three tones), perfect fourth (two tones and one semi-tone). Perfect fifth (three tones and one semi-tone), imperfect fifth (two tones and two semi-tones). Notice that there can be only one pluperfect fourth in an ordinary diatonic scale, *i.e.*, between the 4th and 7th, and only one imperfect fifth, *i.e.*, between the 7th and 4th ascending. Major sixth (four tones and one semi-tone), minor sixth (three tones and two semi-tones. Major seventh (five tones and one semi-tone), minor seventh (four tones and two semitones.

Inversion. An interval which is complementary to another, that is, which makes with the given interval a complete octave, is called the inversion of it. Thus fourths are the inversions of fifths.

(*Mnemonic*, $4 + 5 = 9$, so $6 + 3 = 9$, etc.)

Notice also that if one interval is the *greater* of its kind its inversion will be the *less* of its kind, *e.g.*, a *major* third is the inversion of a *minor* sixth, an *imperfect* fourth is the inversion of a *perfect* fifth.

Tonic Sol-fa Notation. As above, and use of octave marks.

English.

First Year.—Sources from which words have been borrowed.

A. *Celtic.*—(1) Geographical names. (2) Ancient British words as *dun* (brown), *bog*, *crag*, *skip*, *prop*. (3) Welsh words, *bard*, *gull*, *flannel*. (4) Scotch words, *cairn*, *clan*, *gillie*, *plaid*, *whisky*. (5) Irish words, *shamrock*, *shanty*, *mug*, *Tory*.

B *Danish.*—(1) Geographical names (of places in parts settled by the Danes), Grims-*by*, Scaw-*fell*, Scale-*force*, Esk *gill*, Lang-*holm*, *Kirk* wall, *thorp*, Sand-*wich*. (2) Miscellaneous words *are* (pl. of *to be*), *fell* (hill), *harbour*.

C. *Dutch.*—First period, owing to intercourse with the Netherlands in the reign of Edward III., *e.g.*, *cough*, *groat*, *slender*.

Second period, owing to connection in the reign of Elizabeth, *yacht*, *sloop*, *burgomaster*.

Third period, through the South African colonists in recent times, *trek*, *kopje*, *laager*.

D. *Latin*—(excluding French).—First period, during Roman occupation; mostly geographical names, *Chester*, Don-*caster*, Lin-*coln*, *Port*-land, *street*, *wine*, *wall*; the last two words are exceptions to the general rule that words containing *w* are *not* derived from Latin; there is no *w* in Latin, and in these two words the *w* is developed from *v*, *vinum*, *vallum*.

Second period, with introduction of Christianity (including words from Latinised forms of Greek and Hebrew words), *altar*, *abbot*, *pascal*, *canon*, *linen*, *tunic*.

Third period, 1066–1485. In this period it is very difficult to separate words which came to us after having been incorporated in the French language from those that came direct, but the latter may be considered to include all Latin words introduced at that time, which violated the rule for the tonic accent, and for the loss of the medial consonants, *licenciate*, *notability*, *fraternity*, *felicity* (Chaucer).

Fourth period, 1485 to present time. Words borrowed directly from Latin writers.

E. *French.*—Norman-French period, 1066–1350. These words came mainly through the spoken language.

Second period, 1350–1660. Mostly through written language, and hence the words *look* very much more like their Latin originals than those of the Norman-French period. Often the same Latin root supplies a word through each channel forming a doublet, *e.g.*, *benison*, *benediction*.

Third Period. 1660 to present time. These words mostly keep either their French look or their French sound, *e.g. élite*, *fête*, *ballet*, although the tendency is to bring them under the English rules, to sound *ch* in chivalry like *ch* in chip, instead of as *sh*.

The above should be expanded from the text-book. The student is strongly advised to read through Peile's Primer of Philology.

Lycidas.

The complete study of a work such as this comprises two distinct parts:—(*a*) the information gained from external sources which throws light upon and adds interest to the poem; (*b*) that

gained by a study of the poem itself. Bearing this in mind the student should advance to the complete mastery of the poem by the following steps.

(*a*) Read it through several times so as to get the general meaning of the whole, the exact meaning of each sentence, and a sense of the rhythm or music.

10. *he knew himself to sing*, =he himself knew how to sing. Contrast with—'Well! I never knew John to sing!'
29. *Battening our flocks*, =feeding our flocks, cf. 'The wolf shall batten on his bones,' Byron.
33. *Oaten flute*, pipe made of oat straw.
40. *Gadding vine*, wandering vine.
54. *Mona*, the isle of Anglesey.
55. *Deva*, the river Dee.
64. *What boots it*, etc. What does it profit one to watch over the sheep and prepare songs the while?
67. *Use*. As others are in the habit of doing. This verb is seldom used in the present tense to govern an infinitive, though frequently employed in the past:—'He used to sing,' but we never say now 'I use to sing.'
73. *Guerdon*=reward.
76. *Slits*, seldom used now in the sense of to cut across.
77. *foil*, a sort of back-ground employed to show anything up.
102. *sunk*=caused to sink.
107. *pledge*, something pledged, pawned, or entrusted to one's care, a child.
110 *massy*=massive.
118. *Shove*, formerly this word had nothing vulgar about it, neither had its frequentative 'shuffle.' 'Tis not so above, There is no shuffling' (Hamlet.) 'Offence's gilded hand may shove by justice.'
122. *What recks it them*, =What does it matter to them.
130. *Two-handed engine*, =the executioner's axe.
142. *Rathe*, =early. We have a comparative of this rather= sooner, but now only used to express a preference, not sooner in point of time.
176. *Unexpressive*, =inexpressible, ineffable.

(*b*.) Next analyse the subject matter.

Notice first the general form, that of a *pastoral elegy*, in which the poet, under the guise of a shepherd, mourns the death of a fellow-shepherd.

With the following hints the student should make his own analysis:—

Line 1–14. What is the occasion of the lament? Why does Lycidas deserve a poetical lament?
15–22. What does the shepherd hope for who fittingly mourns his friend?
23–36. How was the friendship shown?
37–49. How was the loss of Lycidas felt?
50–55. Why is it appropriate to expect the nymphs of North Wales to watch over a poet?
56–63. What grounds had the poet for supposing that the nymphs could not have protected Lycidas even had they wished?
64–84. How does Phœbus (Apollo) meet the complaint that the 'clear spirit' does not always seem to receive its due reward?
85–131. Again resuming his shepherd mood, what three spirits does the poet see?
89–102. What does Triton state about the cause of the wreck?
103–107. What is the simple lament of the River Cam?
108–131. Give the substance of St. Peter's denunciation of the ecclesiastical authorities.
132–151. What are Alpheus and the Sicilian Muse to call upon the fields and hedgerows to do?
152–164. Why will this be all in vain?
165–185. What has really become of Lycidas?
186–193. How does this epilogue differ in character from the pastoral, which really ends at line 185?

(*c*) The next step is to master the allusions.

The poem is, as we have already stated, a pastoral, and it is generally considered that pastoral poetry took its rise, not so much from a desire on the part of the poet to describe in simple terms 'the homely, slighted shepherd's trade,' as to dress up moral and political teaching in the form of a parable; hence we must expect to find a large number of allusions. It may be said in passing that Theocritus is regarded as the creator of pastoral poetry. He lived in Sicily in the beginning of the third century B.C., and his idylls are much admired. In the 16th he complains of the scanty reward he received from Hiero. The chief Latin pastoral poems are the Eclogues of Virgil. Among English poems of this class are Spenser's 'Shepheard's Calender,' Pope's Pastorals, Shenstone's Pastoral Ballads, and Drayton's Eclogues.

Lycidas represents Edward King, fellow of Christ's College, Cambridge, and a great friend of Milton's. He was drowned in crossing to Ireland in the Long Vacation, 1637, while Milton was still mourning the loss of his own mother, who died in the April.

Line 1. *laurels, myrtles, and ivy* are plants sacred to poetry, and Milton simply declares his intention of writing poetry 'yet once more.' There is no reference to previous poems written in memory of departed friends.

Line 15. *Sisters of the sacred well*, the nine Muses, said to be the daughters of Jove, and to live beside the spring of Pieria, at the foot of Olympus, the mountain sacred to Jove. These divinities were supposed to inspire poets.

Line 19. *Muse*, here a poet. Note the masc. 'he' in line 21.

Lines 23–36. Refer to the studies and poetical attempts in which Milton and King worked together.

34. *Satyrs* were rural deities fond of music and wine, who belonged to Greek mythology, while Fauns belonged to Roman; but the two are often confused.
36. *Damœtas*, a shepherd mentioned in Virgil's third Eclogue: 'Dic mihi, Damœta, cujum pecus.' The allusion is probably to William Chappell, who was tutor to both at Cambridge, and probably encouraged their poetry.
50. *Nymphs*, female divinities, who were supposed to people seas, rivers, grottoes, and trees.
58. *Orpheus*, a fabulous poet or minstrel of antiquity, said to be the son of Calliope, the Muse of epic poetry, and to have been killed by the Thracian women in a fit of drunken anger, and his head torn off and thrown into the river Hebrus (now called Mariza), whence it floated across the Ægean Sea to the island of Lesbos (now Mitylene).
66. Milton evidently had in mind the second line of Virgil's first Eclogue: 'Silvestrem tenui Musam meditaris avena.' Thou meditatest the sylvan muse on thy slender oaten pipe.
68. *Amaryllis*, a maiden beloved of Tityrus in Virgil's first Eclogue.
69. *Nesera*, a nymph or maid, in Virgil's third Eclogue.
75. *blind Fury*, the three Fates, or Parcae, were: (1) Cletho, who spun the thread of fate; (2) Lachesis, who allotted his fate to each man; and (3) Atropos, who cut the thread of fate with her shears. The name Atropos does not signify that she was blind, but that it was impossible to 'turn away from' or avoid her.
77. *Phœbus*, the same as Apollo, the god of poetry and of prophecy.
82. *Jove*, the chief god, called also Jupiter, *i.e.*, Jove-pater.
85. *Arethuse*. The fountain Arethusa was in the island of Ortygia, near Syracuse, hence the spring from which Theocritus drank his inspiration.
86. *Mincius*, now the Mincio, a river running into the Po near Mantua, the birthplace of Virgil.
90. *Neptune*, the god of the sea, who sends a herald to clear himself from blame in the matter of the shipwreck.
96. *Hippotades* = son of Hippotes, *i.e.*, Æolus, the god of the winds. He was not particularly noted for wisdom, hence Milton probably used 'sage' in the same sense as the French 'sage'—well-behaved.
99. *Panope*, one of the sea-nymphs.
109. pilot of the Galilean lake. St. Peter.
110–111. See St. Matthew xvi. 19. The Pope of Rome still uses two keys crossed as his armorial bearings.
120. *Sheep-hook*, the crozier.
132. *Alpheus*, now called the Ronfia, the chief river in the Peloponnesus, running through *Arcadia*, the pastoral part of Greece.
155–162. *Whether*, etc. Whether the corpse had drifted northward towards the Hebrides or southward to the English Channel.
163. *Angel, i.e.*, St. Michael, who is said to have appeared at Mont St. Michel in 708. In the Chanson de Roland St. Michael is sent to carry heavenwards the soul of the expiring hero.
164. *Dolphins*. Dolphins are mammals—not fish—like the whale. The poet Arion is said to have been carried to Corinth by dolphins after being cast overboard by sailors.
189. *Doric lay*, after the style of Theocritus, who was born at Syracuse, which was a Doric colony.

(*d*) Next the versification should be studied. The lines are iambic pentameters, or ten-syllable lines, with the accents on the

2nd, 4th, 6th, 8th, and 10th syllables. Note the exceptions; the first foot is often a trochee, 'Shátter,' 'Bitter.' Note the effect of the short lines inserted here and there, 'And all their echoes mourn.' Observe the arrangement of the rhymes; the poem does not consist of unvarying couplets, like Pope's writings. Notice how the form suits the subject.

(*e*) Now notice peculiarities in the grammar, *e.g.*, the singular number of the verb 'compels,' in line 7, although it has two nominatives joined by 'and.' The reason is that the words 'constraint' and 'occasion' stand for the same thing; so we should say, 'The ripest scholar and the greatest poet of the age *is* dead,' if the scholar and the poet were the same.

(*f*) Go carefully through the derivation of the more important words with the help of a good dictionary, such as Skeat's.

We have treated this poem at much greater length than we shall be able to treat the other authors in the full assurance that a student who works at it on the lines we have indicated will not only master it for examination purposes, but will acquire a sort of affection for this beautiful poem itself, and a power to deal satisfactorily with any other work of the same kind he may take up.

SECOND YEAR.—Contrast the character of the Duke with that of his brother, and that of Oliver with that of his brother Orlando.

Work out in detail the parallel between the circumstances of King Lear and those of the Duke of Gloucester.

CLIMATE, PRODUCTIONS OF INDIA.

Before studying climate of India read up 'Periodic winds' from any good book of physical geography. India is a monsoon country; the S.W. monsoon blowing in summer, and the N.W. in winter; the former, the great rain-bearing wind, bringing heavy rainfalls to West Coast Plain and Western Ghats (Mahabuleshwar 250" annually), the Ganges Valley, Khasia Hills, in Assam (600" annually). Note slight rainfalls in East Coast Plain (winter rains), and parts of Indus Valley.

Commercial and political geography.—Industries, Commerce, Government, People, Cities, etc.—Manufactures are important and are growing: note large and comparatively new manufactures of cotton, silk, jute.

In studying commerce, observe (*a*) countries traded with (England, China, by sea; border countries by land); (*b*) imports and exports; (*c*) chief sea and land trade routes; (*d*) the ports of Bombay and Calcutta having nearly all the foreign trade, Madras and Karachi the corn ports, and Surat the cotton port.

Internal communication.—Mark the most important railways on a map, and learn a few of the chief stations on each line.

Ceylon.

British Beluchistan.—Quetta, and the Bolan are administered by England. Note recent operations on the Indian North-West Frontier; also railway of Zhob Valley. Quetta, the military key of country, has been occupied by British since 1877.

BRITISH POSSESSIONS IN AMERICA.

1. *In North America.*—Dominion of Canada, Newfoundland and Labrador, Bermudas.

2. *In Central America.*—British West Indies, British Honduras.

3. *In South America.*—British Guiana, Falkland Islands.

DOMINION OF CANADA.—Study the exact southern boundary, and the position of each of the Provinces and Provisional districts constituting the dominion.

The *build* is simple, the greater part of the country being a plain sloping N. and N.E., with mountains on its western side, and hills on the eastern.

Note the natural division into:—Woodland region in east, prairie region in centre, and mountain region in west.

The Rivers and Lakes.—Three of the four great rivers of North America are in the dominion.

The St. Lawrence is the great commercial highway. It is naturally navigable to Quebec: the bed has been deepened so that the largest sea-going ships reach Montreal, above which the rapids and falls are avoided by means of canals.

Draw map of river and mark in chief canals.

Climate.—Consider the effect of—

(1.) The slope of country northward, and absence of mountains to shield from Arctic winds.

(2.) The cold arctic current along east, and fragment of warm black stream along west.

(3.) The great lakes in Province of Ontario.

Productions.—The sources of wealth are the forests, pastures, wheatlands, fisheries, mines.

Study products of these, and note which are among exports.

Occupations of People.—These may be gathered from above; note that the manufactures are connected with the pastoral and agricultural pursuits.

Commerce, Ports, Internal Communication [Railways, Rivers, Canals], Government.

Provinces and Provisional Districts.—Study position of each, chief productions and industries, and most important towns.

HISTORY (*both years*).

Careful study of the reign of Charles I. from 1625 to 1642, the outbreak of the Civil War.

The King's character; read the essays on 'Charles I.,' and on 'The secret history of Charles I. and his Queen Henrietta' in D'Israeli's 'Curiosities of Literature.'

Buckingham, chief adviser; see the essays on 'The Duke of Buckingham,' and on 'The minister—duke of Buckingham,' lord admiral, lord general, &c., &c., &c., in D'Israeli's 'Curiosities of Literature.'

Early opposition of Parliament, the leading men. Second Parliament 1626 dissolved by Charles for impeaching Buckingham. Methods of raising money,

Expedition against La Rochelle.

Third Parliament—Petition of Right.

Charles absolute 1629–1640. His supporters, Laud and Strafford; their methods and sphere of action. Courts of Star Chamber and High Commission.

Ship-money, its origin, extension to inland parts.

Hampden's opposition; his trial and its effect on the country.

Religious opposition in Scotland. Solemn League and Covenant.

The Short Parliament (April 13 to May 5th, 1640).

The Long Parliament. Leading men. Attack on Strafford and Laud. Attainder and Execution of the former.

Triennial Act 1641. Repealed 1664. Compare with Triennial Act of 1694, and with Septennial Act of 1716, now in force.

Grand Remonstrance. Attempt on the five members of the House of Commons.

GEOMETRY.

WOMEN.—*First Year.*—To end of Prop. VIII.

MEN.—*First Year.*—Complete the revision of the First Book, with exercises.

MEN.—*Second Year.*—Finish Book IV,, paying special attention to Prop. 10, a very interesting one; the others are long but fairly simple.

ALGEBRA.

WOMEN.—Multiplication of binomial expressions at sight, and the converse, viz., factorisation of expressions.

Men.—First Year.—Factors; determination of H.C.F. and L.C.M. (*a*) when the factors are easily found, (*b*) by the general rule.

Second Year.—Read chapter on Mathematical Induction in Todhunter's Larger Algebra or in a work on Logic, then take up Chapter on Binomial Theorem.

LATIN.

Both Years.—Revise the Regular Verbs (both voices), and lists of principal parts of verbs differing at all from the type.

Translate and retranslate 'In Catilinam,' ch. 4–6.

Second Year.—Prepare in addition, Æneid ix. 25–167.

FRENCH.

Both Years.—Verbs, regular and irregular. Study these in connection with the rules for the formation of the tenses, and instead of trying to commit each irregular verb to memory as an independent collection of forms, note carefully the points in which it departs from the regular forms, and, if possible, find out the reason for the departure.

Translate 'Voyage autour de ma Chambre' to end of Chap. XIV. (Joannetti), and retranslate passages of your English as recommended last month.

Second Year.—Prepare in addition 'Le Verre d'Eau' to end of Act I.

TEXT-BOOKS.

Since writing the list of text-books in last month's issue, we have received from the Cambridge University Press copies of 'Cicero In Catilinam I.,' and 'Milton's Comus and Lycidas'; both of these little volumes are admirably prepared, and our readers will find them of the greatest use.

Mr. Cowham's third contribution (fully illustrated) dealing with 'The School Journey' will appear next month.

QUERY COLUMN.

RULES.

1. Each correspondent is restricted to *one* question.
2. Each query must be accompanied by the *coupon* which appears on the back wrapper of the current number of the Journal.
3. CORRESPONDENTS MUST IN ALL CASES STATE THE SOURCE FROM WHICH THEIR QUERY HAS BEEN OBTAINED.

The Editor reserves to himself the right to decline to answer any question which is, in his judgment, unsuited to the Magazine.

Phig.—See Dr. Overend's notes in Science Section.

B.R.B.—Apply to Messrs. Hachette and Co., King William Street, Strand, who publish excellent editions of books required. For Livy xxxiii., try U.C.C., Burlington House, Cambridge.

Jan.—Ash saplings after five years' growth are worth 1s. 3d. and increase in value 1s. 3d. each year afterwards. For their growth they each require twice as many square yards as the number of years they are intended to grow before cutting. A plantation is arranged so that each year the same number may be ready for cutting. Find the greatest annual income which can be obtained per acre, allowing 20 per cent. for expenses.

(Pendlebury's 4s. 6d. Arith., Prob. 225.)

See 'Query Column,' June 1898.

R. A. Holden.—See Oct. 'P. T.' for text books.

Read Nixon's Euclid Revised, Book V., or Hall and Stevens' Euclid, Book V. Also consult any of the text books of Algebra referred to in Stage 3 in the November 'P. T.'

Joan.—1. The area of a floor of a room is 651 sq. ft., of the larger walls together, 806 sq. ft., of the two shorter walls together, 806 sq. ft. Find the length, breadth, and height of the room. (Cusack's Arith., p. 239.)

Have you not misquoted the area of the shorter walls?

2. A man who can row three miles an hour in still water finds that it takes him three hours to row a certain distance up stream, and two hours to row down again. How far does he row altogether? (Cusack's Arith., p. 458.)

We must find the speed of the stream.

Let AC (A, B, C, D, are in order in a straight line) represent his speed in still water, and CD or CB the speed of the stream. The question clearly tells us that his speed up stream is $\frac{2}{3}$ his speed down. Hence, from the figure we have $AB = \frac{2}{3}AD$, $\therefore BD = \frac{1}{2}AB$, $\therefore BC = \frac{1}{2}AB = \frac{1}{5}AC$. That is, the speed of the stream is $\frac{1}{5}$ of 3; hence, his speed down is $3\frac{3}{5}$, and up, $2\frac{2}{5}$.

Therefore down stream he goes $2 \times 3\frac{3}{5}$, and up stream, of course, the same, *i.e.*, $4 \times 3\frac{3}{5}$, or $14\frac{2}{5}$ miles.

Rusticus.—If two straight lines intersect at A, and if A, P, B, Q and A, p, b, q are two harmonic ranges, one on each straight line (the points corresponding as indicated by the letters), then Pp, Bb, Qq will be concurrent: also Pq, Bb, Qp will be concurrent. (Hall and Stevens' Euclid, Book VI. p. 362.)

We assume that you have established Theorem 2; you may establish Theorem 5 by the aid of this.

For if Pp and Qq meet in E, draw EB cutting Aq in b; then the pencil E (APBQ) is harmonic and Aq is a transversal, therefore Apb_1q is a harmonic range; but Apbq is a harmonic range, therefore b and b_1 must coincide, that is, Bb also passes through E.

Similarly, if Qp and Pq meet in O, the pencil O (QBPA) is harmonic, and Aq a transversal, so that b must lie on OB.

X. Y. Z.—Prove, geometrically, that the sum of two sides of a triangle is to their difference as the tangent of half the sum of the opposite angles is to the tangent of half their difference.

See PRACTICAL TEACHER, July 1895. Solutions of May Exam. Questions.

A Blighter.—If three quantities are in A. P., find the condition that their squares may be in G.P. (Certificate Exam., 2nd Year, 1897.)

Let x, y, z be the numbers, then one relation between them is $x + z = 2y$. We are asked to find some other relation which must exist if their squares are in G.P., that is, if $x^2z^2 = y^4$. These two equations may be written

$$\frac{x}{y} + \frac{z}{y} = 2 \quad (1)$$

$$\left(\frac{x}{y}\right)^2 \cdot \left(\frac{z}{y}\right)^2 = 1 \quad (2)$$

or $$m + n = 2 \quad (3)$$

and $$m^2n^2 = 1;$$

$\therefore$ $$mn = \pm 1. \quad (4)$$

Solve (3) and (4) simultaneously, taking both cases of (4), and the result is $m = n$, or

$$m = 1 + \sqrt{2}, \text{ or } 1 - \sqrt{2},$$
$$n = 1 - \sqrt{2}, \text{ or } 1 + \sqrt{2};$$
$$\therefore \quad \frac{m}{n} = (-3 + 2\sqrt{2}), \text{ or } -(3 - 2\sqrt{2}).$$

But $\frac{m}{n} = \frac{x}{z}$, therefore the required condition is that the ratio of the first to the last quantity must be one or the other of the quantities $-(3 + 2\sqrt{2})$ and $-(3 - 2\sqrt{2})$. The first solution $m = n$ means that $x = y = z$, in which case the common difference is 0.

Cattock.—How many numbers less than 500 can be made by taking one or more of the numbers 4, 6, 3? (Cert. Exam., Scotland, 1897.)

The 6 cannot occupy the hundreds place.

Numbers containing one digit, 3.

,, ,, two digits, ${}_3P_2 = 3 \times 2 = 6$.

,, ,, three ,, ${}_3P_3 - 2 = 6 - 2 = 4$.

Total 13.

Cromarty.—A man, after a tour in Switzerland, found that he had spent every day half as many shillings as the total number of days he had been from home. His tour cost £57 12s. How many days did it occupy? (Pendlebury, p. 359, No. 475.)

He spends each day as many sixpences as the total number of days from home, hence if the latter be n we have, since £57 12s. = 2,304 sixpences,

$$1 + 2 + 3 + 4 + \ldots + n = 2304;$$
$$\therefore \frac{n}{2}(n + 1) = 2304,$$
$$n^2 + n = 4608,$$
$$n^2 + n + \tfrac{1}{4} = 4608\tfrac{1}{4} = 18433 \div 4.$$
$$\therefore n + \tfrac{1}{2} = \sqrt{\frac{18433}{4}}$$
$$= 68 \text{ nearly.}$$

As there is no exact square root of 18433, the total number of days cannot be integral.

With regard to the next question you need only observe that by A parts with $\frac{1000}{3}$ acres and B with $\frac{7000}{3}$, hence A will draw one seventh of what B draws, that is $\frac{1}{7}$ of £8,000, or £1,000.

Wood.—(1) Find k in order that $x^3 + y^3 + z^3 + kxyz$ may be divisible by $x + y + z$.

(2) If $(a + bx)^2 + (c + dx)^2$ and $(a + qx)^2 + (c + sx)^2$ be perfect squares, then $(b + qx)^2 + (d + sx)^2$ will also be a perfect square.

(1) Divide $x^3 + y^3 + z^3 + kxyz$ by $x + y + z$ until you find, on subtracting, that the remainder is $-yz^2 - y^2z + (k + 2)xyz$. Then you say, $x + y + z$ will divide into this $-yz$ times if k be equal to -3.

(2) You require to know that if $a + bx + cx^2$ is a perfect square, then

$$ac = \left(\frac{b}{2}\right)^2,$$

or (constant term)(coeff. of x^2) = (half coeff. of x)^2.

Hence, if the first of the given expressions be a perfect square,

$$(a^2 + c^2)(b^2 + d^2) = (ab + cd)^2,$$
$$i.e., \quad a^2d^2 + b^2c^2 = 2abcd,$$
$$i.e., \quad a^2d^2 - 2abcd + b^2c^2 = 0,$$
$$i.e., \quad (ad - bc)^2 = 0,$$
$$i.e., \quad ad - bc = 0,$$
$$i.e., \quad \frac{a}{c} = \frac{b}{d}.$$

Similarly from the second expression we get

$$\frac{a}{c} = \frac{q}{s}.$$

Therefrom combining the two results we have

$$\frac{a}{c} = \frac{q}{s} = \frac{b}{d}.$$

But, as above, the condition that the third expression is a perfect square reduces to

$$\frac{b}{d} \text{ must} = \frac{q}{s}.$$

Therefore since this is true, the third expression *is* a perfect square.

Several queries are unavoidably held over. Correspondents may have printed solutions upon application to Editor *P. T.*

OUR SCIENCE SECTION

Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.

CHEMISTRY NOTES.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
First Class Honourman in Chemistry (Science and Art Department), Head Master, Finchley School of Science, and Lecturer therein on Chemistry.

THE BRITISH ASSOCIATION AND CHEMISTRY.

(*a*) **New Elements.**—(1) **Monium.** This is the name given to a new rare earth, the spectrum of which—discovered by Sir W. Crookes—consists of a group of lines standing alone in the ultra violet end of the spectrum. It is supposed to have an atomic weight between yttrium and lanthanum. Naturally, an element so situated has many affinities, being directly opposed to the inert nitrogen group in this respect.

(2) **Xenon.** Prof. Ramsay discovered this gas, one of the companions of argon and neon, to use Ramsay's own words, by the fractional distillation of liquid air, liquid argon being thus obtained. 'The last fractions of liquefied argon show the presence of three new gases. These are **krypton,** a gas first separated from atmospheric air and characterised by two very brilliant lines, one in the yellow and one in the green, besides fainter lines in the red and orange: **metargon,** a gas which shows a spectrum very closely resembling that of carbon monoxide, but characterised by its inertness, for it is not changed by sparking with oxygen in presence of caustic potash; and a still heavier gas, which we have not hitherto described, which we propose to name **Xenon.**' Xenon is very easily separated, for it possesses a much higher boiling point, and remains behind after the others have evaporated. This gas, which has been obtained practically free from krypton, argon, and metargon, possesses a spectrum analogous in character to that of argon, but differing entirely in the position of the lines. With the ordinary discharge the gas shows three lines in the red and about five very brilliant lines in the blue; while with the jar and spark-gap these lines disappear and are replaced by four brilliant lines in the green, intermediate in position between the two groups of argon lines, the glow in the tube changing from blue to green. Xenon appears to exist only in minute quantity.

Helium in the Atmosphere.—Mr. Baly, of University College, London, writes as follows to *Nature* for Oct. 6th:—'C. Friedländer and H. Kayser have independently claimed to have found helium in the atmosphere. On examination of some photographs of the spectrum of neon I have identified six of the principle lines of helium, which thus establishes beyond question the presence of this gas in the air. The amount present in the neon is, of course, impossible to estimate, but the green line (wave length 5016) is the brightest, as would be expected from the low pressure of the helium in the neon.'

This Prof. Ramsay accepts as conclusive, stating, however, that 'the presence of helium in no way alters our view of the position of neon in the periodic table. The number 9·6 implies an atomic weight of 19·2; and a somewhat higher atomic weight would even better suit a position between fluroine 19 and sodium 23.'

(*b*) **Equivalent Displacement of Metals.**—The simple experiment whereby the immersion of magnesium in a solution of cupric sulphate sets free metallic copper and forms magnesium sulphate has been carefully studied by Messrs. Clowes and Caven, who, in their paper read before the British Association, show how complex an apparently simple chemical reaction may really be. It was found that when boiled cupric sulphate deposits a basic salt of the formula $4CuSO_4 . 7Cu(OH)_2 . H_2O$, hence a boiling solution must not be used. The best results are obtained with a hot solution of the copper salt, but the reaction is never one of simple replacement, for (1) hydrogen is evolved, (2) cuprous oxide is formed, and (3) a basic sulphate is produced. The hydrogen is partly accounted for on the assumption of the hydrolysis of the cupric salt, whereby sulphuric acid is formed, but the authors opine that this accounts in part only for the evolution of hydrogen, and promise a further explanation of this puzzling part of the reaction.

In the case of the action of iron on a solution of cupric sulphate, the reaction is the simple one represented by the equation

$$Fe + CuSO_4 = FeSO_4 + Cu.$$

The immediate separation of cuprous oxide and evolution of hydrogen, without formation of basic salt, which occurs at the commencement of the reaction, may be represented by the equation

$$2\,Mg + 2\,CuSO_4 + H_2O = 2\,MgSO_4 + Cu_2O + H_2.$$

The action of the magnesium-copper couple has been proved to be too slow to explain the rapid escape of hydrogen, and if this were the origin of the hydrogen, its escape would not immediately follow the immersion of the magnesium. Altogether the reaction is a very interesting if a very tantalising one, and the further report promised will be awaited with interest.

A New Form of Drying Tube.—Prof. Vernon Harcourt, F.R.S., described at Bristol a very convenient form of drying tube, wherein the number of corks needed is reduced to one, and leakage reduced to a minimum. It consists of a tube about 8 in. high and 1 in. wide. Two inches from the bottom there is a constriction, below which, nearly at the bottom, is a delivery tube sealed into the main tube. A piece of pumice large enough to block the constriction is dropped into the tube, and smaller portions are piled above this. Sulphuric acid is poured upon these pieces of pumice, and collects at the bottom of the main tube. The gas entering by way of the delivery tube, bubbles through the acid and then passes through the soaked pumice, and is thus effectually dried. A piece of gummed paper placed at the level of the acid collected at the bottom of the tube indicates by the rise of level above this the extent of hydration of the acid, which is changed at will by being poured out by way of the delivery tube.

Calcium Hydride (CaH_2) by Moissan. — Pure crystallised calcium is put into a nickel boat in a glass tube traversed by a current of pure dry hydrogen. The hydrogen is purified by being passed through two porcelain tubes at a red heat, one filled with copper and the other with pure boron. It is then dried with fused potash and phosphoric acid, previously calcined in a current of oxygen. At the ordinary temperature calcium does not react with hydrogen.

When the tube containing the nickel boat has been well swept by a rapid current of hydrogen the end of the tube is sealed, and the hydrogen is kept in it at a pressure of from 30 to 40 cm. of water. The temperature of the boat containing the calcium is then slowly raised, and when it reaches a dull red heat, we can see it take fire in the atmosphere of hydrogen. The gas is absorbed with great rapidity, and we obtain in place of the metal a white substance which is hydride of calcium, the density of which taken in essence of turpentine is 1·7. The most curious reaction of this new compound is that which takes place with cold water; as soon as hydride of calcium comes in contact the water is decomposed with violence, and both the hydrogen of the water as well as that of the hydride is given off, while hydrated oxide of calcium is formed.

$$CaH_2 + {}_2H_2O = Ca(OH)_2 + {}_3H_2.$$

A quick supply of Chlorine (*answer to query*).—In several simple experiments, as with H_2S and NH_3, it is often required to speedily prepare a supply of chlorine. We have found that this is best done by means of the reaction of permanganate of potash upon hydrochloric acid, the reaction taking place at once and in the cold. The HCl should be concentrated.

$$KMnO_4 + 8HCl = KCl + MnCl_2 + 4H_2O + 5Cl.$$

Another quick method is to place about 20 grms. of good bleaching powder in a flask fitted with thistle-funnel and delivery tube, and to pour on it dilute sulphuric acid; the equation is

$$Ca(OCl)\,Cl + H_2SO_4 = H_2O + CaSO_4 + Cl_2.$$

Baryta as a CO_2 absorbant.—MM. Albert Lévy and Henriet have made a daily examination of the atmospheric CO_2 for the last twenty years, and they showed that the loss due to what escapes from the potash is a negligible quantity; they have always maintained that baryta is far the best absorbent of carbon dioxide, and by making two estimates simultaneously with potash and baryta, they have arrived at some interesting results. On the outskirts of Paris they got practically the same results in each case, but in the city of Paris baryta gives a decidedly higher figure.

PHYSIOGRAPHY NOTES.

Sun Spots, Aurorae and Magnetic Storms.—The connection between these phenomena has been again demonstrated in a striking fashion during the last few weeks. On September 3rd, a very large spot appeared on the sun's disc at the eastern limb. By September 9th this spot was on the central meridian, when it caused the aurora and the magnetic disturbance to be referred to later on. On September 30th this spot again appeared on the eastern limb, its dimensions having been sufficiently great to enable it to last through a complete rotation of the sun. The umbra is divided into three separate parts, and the spot is accompanied by several other smaller spots. Although the large spot shows little change, the smaller ones, even in one day, change very considerably. So far no accounts have reached us of any auroral displays on the occasion of the spot's second meridianal passage on October 6th.

The Aurora of the 9th September.—Immediately after dark, about 7 p.m , the main arc was distinctly seen above the northern horizon, and as the sky gradually became less luminous, numerous streamers of varying brightness made their appearance at Kensington, where the ground lights were somewhat glaring ; the main arc appeared simple, and not made up of several parallel arches, as is often the case with bright aurorae. Its extent would be about 60° in azimuth, the upper limit of the arch being about 20°. This was continuously very bright throughout the evening, and the maximum brightness was very conspicuous in the *magnetic*, and not the *geographical*, north. The intensity, number, and extent of the streamers varied considerably, and in no case did any particular streamer last more than ten minutes. At one time, about 8 p.m., two large streamers were noticed much extended towards the zenith, having a length of about 130°, and frequently the whole northern arc was bounded by radiating glows extending about 40° or 50°. No corona was seen during the display, but several times a set of large streamers, in breaking up, formed masses of numerous auroral clouds, which were scattered on the whole celestial hemisphere.

The only colour observed was pure violet, which, perhaps, a tinge of green, but no trace of ruddiness was at any time visible.

The dark patches frequently seen in previous aurorae, bounding the northern horizon under the main arch were very distinct, and although resembling ordinary clouds in form, were evidently connected with the disturbance. Observations with the spectroscope showed the greenish-yellow light with ease, and the spectrum was bright enough to exhibit several bands extending through the green, blue, and violet, a dark interval at the extreme violet end reminding one forcibly of the carbon band spectrum at this region.'—*Nature.*

Magnetic Storm.—On the evening of the 9th September the large automatic recording instrument for magnetic declination at South Kensington showed unmistakable signs of great disturbance in the photographic record, the disturbance beginning at 7.30 and continuing for an hour, during which time the declination magnet was deflected over 1°. Dr. Chree, of the Kew Observatory, in a letter to *Nature*, describes similar disturbances as recorded at his station, and from all over the kingdom messages were received complaining of difficulties experienced in the transmission of telegraphic messages, which in itself is a proof of the intensity and extent of the magnetic storm, the cause of which was undoubtedly the sun spot above described.

A new Planet.—The discovery of a new asteroid between Mars and Jupiter awakens but little interest. It is quite otherwise, however, when a tiny planet revolving between Mars and Earth is discovered, which is what Herr G. Witt, of the Urania Observatory, Berlin, has done. The revolution of this new planet is completed in about 600 days, or about 80 days less than the period of the revolution of Mars. Both the eccentricity and the inclination of this, our nearest neighbour after the moon, are considerable. The discovery was made on August 14th by means of an exposed photographic plate, and the particulars referring to this latest of the asteroids have been worked out by Herr Berberich.

The Nebula of Andromeda.—Seraphimoff announces from Kiel that he has discovered a stellar-like condensation in the neighbourhood of the centre of this nebula. This recalls the fact that in 1885 a star of 6·5 magnitude was observed near the centre of the nebula of Andromeda, which gave a continuous spectrum believed to contain a few bright lines. In the opinion of Espin this nucleus was variable, and he thought that he could see stars in it, which Young confirmed by means of his 23-inch refractor. On the 21st September the 30-inch reflector of the Solar Physics Observatory at South Kensington was brought to bear upon the nucleus, which appeared to the observers to be more of a stellar nature than usual, and to be elongated, although the spectroscope indicated a continuous spectrum without any visible bright lines.

A Great Boulder.—The gypsum boulder, weighing not less than thirteen tons, which was found in the boulder clay at Great Crosby, is to be placed upon a granite pedestal, protected by wrought iron railings, in the Liverpool Road, Great Crosby. Such a notable boulder is worthy of such preservation, and will be an interesting object of attention to all geologists and physiographists.

The Hurricane in the West Indies and the Barometer.—Mr. H. Powell, Curator of the Botanic Gardens, Kingstown, shows that the barometer gave timely warning of the approach of the storm that devastated the West Indies a month ago. At 3 p.m., Sept. 6th, the reading was 29·926 inches. On Sept. 10th this had fallen to 29.838 inches, and storm warnings were issued. At 5.55 a.m., Sept. 11th, 29·724 inches were recorded, at which time fitful gusts of wind were blowing from N. and N.W. By 9 a.m. the mercury had again fallen, this time to 29·606 inches, the wind now rushing from N. to W. An hour later the reading was 29·539 inches, and a gale was blowing from N.N.E. sufficiently strong to uproot the largest trees. At 11·40 a calm set in, the barometer at this time standing at 29·509 inches. It was found that 4·94 inches of rain had fallen in the three hours between nine o'clock and noon. Suddenly, at 12·25, the wind began to blow from the S., its force increasing every minute, trees and houses that had withstood the force of the former gale being hurled to the ground. At 2·30 p.m. the wind slackened, and at 3 p.m. the barometer had risen to 29·533 inches. It was estimated that fourteen inches of rain fell in the twenty-four hours.

The Sub-Oceanic Physical Features of the Atlantic Ocean was the subject of a paper contributed by Prof. Hall to the British Association at their Bristol meeting, in which he showed, by reference to the depth contour charts of the Admiralty, that the British and Continental submarine platform breaks off abruptly in a grand escarpment, at depths varying from 100 to 250 fathoms. This escarpment, from 6,000 to 7,000 feet high, is, according to the Professor, indented by deep bays and old river channels, the latter almost cañon-like in places, being often prolongations of the river valleys of the existing land. Judging from this and other data, Prof. Hall opines that the whole area of the North Atlantic, to a depth of 10,000 feet, was within a very recent period a land area, in which opinion Prof. Hall is in agreement with Spencer and Upham. On the other hand, it was contended by some of Prof. Hall's auditors that the physical features of the ocean bed referred to by him might be the result of submarine disturbances.

Jupiter during the Opposition of 1898.—Signor J. Comas Salá, of the Observatory of Catelá, made the following observations from Jan. 18th to June 12th. The general aspect of the planet indicated a period of relative calm. This was especially so with the northern equatorial belt, which showed a uniform structure of a deep ruddy colour. The equatorial zone was of an intense yellowish orange colour, and in addition to the oblique grey markings usually seen, the whole zone appeared flaky, being made up of large and small dark round spots. The red spot was always very pale and grey, but the whole of its elliptic contour was visible in spite of this. The eastern portion always appeared darker than the rest, and sometimes a small dark spot could be seen in this position. From three transits of the eastern portion of this spot in April, May, and June, the mean Jovian longitude was found to be 36°6 for May 23rd.

Macmillan's Illustrated Prize Library continues to increase in size and in variety of interest. **The Romance of the Insect World** (L. N. Badenoch) is a charming book, and well illustrated. This handy edition is well fitted to stimulate our young folks to an intelligent interest in nature and its real fairyland of wonders. Canon Atkinson's **Scenes in Fairyland** deals with that other fairy domain which is little less real to the young, and they will revel in its scenes of dainty splendour where imagination runs riot among the 'good folk' of our nursery days. A stirring tale of adventure in the days of Good Queen Bess, with a careful and life-like picture of the earlier life of Francis Drake, is ready to the hands of our boys in Julian Corbett's powerful story **For God and Gold**, and they will rise reluctantly from its perusal, but so much the richer for an understanding of a bit of the history of their land such as school histories cannot give. **The Revolt of the Young MacCormacks** is a good story of the unauthorized doings of a bright family of Irish children and the consequences thereof. It is moreover a careful study of child-nature, and for its insight into the workings of the juvenile mind it may be strongly recommended as a ho lida exercise in 'child-study' to all practical teachers.

☛ **The PRACTICAL TEACHER'S ART MONTHLY is the only Monthly which is devoted solely to primary school Art and Manual work. Personal advice is given to all Teachers who need it by a staff of experts engaged on the paper.**

☛ **For Dr. Overend's 'Notes on Advanced and Honours Physiology,' see page 276.**

NOTES ON THEORETICAL MECHANICS.

BY F. CASTLE, M.I.M.E.,

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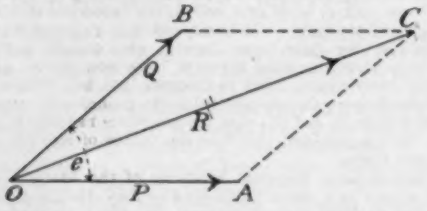
ADVANCED AND HONOURS STAGES.

WE may next, with advantage, consider briefly the action of two or more forces acting at a point, but not in the same straight line, and the general conditions of equilibrium for any number of forces.



Let two forces, P and Q, represented in magnitude and direction by OA and OB respectively, act upon a particle at O, the resultant OC is readily obtained by drawing BC parallel to OA and AC parallel to OB, intersecting at C, then OC represents the resultant R in direction and magnitude, and CO or OC reversed in direction, or is the equilibriant. The three forces CO, OB, and OA, acting at a point O, form a system of forces in equilibrium, and these are appropriately represented by the triangle OAC, the magnitude of the forces by the number of units of length in the sides of the triangle, and direction by following round the sides of the triangle in order from O to A, A to C, and C to O; the triangle OAC is called the *triangle of forces*.

Denoting the angle between P and Q by θ, then $R^2 = P^2 + Q^2 + 2PQ \cos \theta$, when θ is less than 90°.

When θ is greater than 90°, then $R^2 = P^2 + Q^2 - 2PQ \cos \theta$.

It will be of assistance to note that R increases as θ diminishes, and when θ is zero, $\cos \theta = 1$ and

$$R^2 = P^2 + 2PQ. \quad \therefore R = P + Q.$$

P and Q are then acting not only in the same direction, but also in the same line.

When θ is 180°, $\cos 180° = -1$, and $R^2 = P^2 + Q^2 - 2PQ$; $\therefore R = P - Q$. The two components are now in the same line, but act in opposite directions; when θ is 90°, then $\cos \theta = 0$. $\therefore R^2 = P^2 + Q^2$, and this is of course evident from properties of the right-angled triangle.

The *parallelogram law*, to which we have just referred, is applicable to all physical *directional quantities*, such as *forces*, *velocities*, *accelerations*, etc.

Ex. 1. Find the cosine of the angle between the directions of forces of 5 and 7 units which have a resultant of 8 units. Show that the angle itself exceeds 90°. (1887.)

Solution.—From the formula

$$R^2 = P^2 + Q^2 + 2PQ \cos \theta$$

we have, substituting the given values,

$$8^2 = 5^2 + 7^2 + 2 \times 5 \times 7 \cos \theta;$$

$$\text{or, } 2 \times 5 \times 7 \cos \theta = -10.$$

$$\therefore \cos \theta = -\tfrac{1}{7}.$$

The negative value of the cosine indicates that the angle lies between 90° and 180°.

Ex. 2. Draw a triangle ABC, and take D and E, the middle points of BC and CA respectively. If forces P, Q, R act from A to B, A to C, and C to B, respectively, and are proportional to the length of the sides along which they act, show that their resultant acts from E to D, and is equal to 2P. (1895.)

Ex. 3. Three forces, P, Q, R, act at a point O, and are in equilibrium. Show that

$$(a) \quad \frac{P}{\sin QOR} = \frac{Q}{\sin ROP} = \frac{R}{\sin POQ};$$

$$(b) \quad P^2 = Q^2 + R^2 + 2QR \cos QOR.$$

If the magnitudes of the three forces in equilibrium are 12, 15, and 19 respectively, show, in a diagram drawn to scale, how they act. (1897.)

Ex. 4. Draw a square, ABCD, and a diagonal, AC; forces of 1, 2, 3, 4 units act from A to B, from B to C, from C to D, and D to A, respectively. Find the sum of their components along AC, and also the sum of their components at right angles to AC.

What is the magnitude of the resultant of the given forces? (1897.)

Ex. 5. A rod (AB) of uniform density is fastened by a hinge at A to the lowest point of a hemispherical bowl, and rests with the other end (B) against the inner surface of the bowl. Find the pressure on the bowl at B, and on the hinge at A, the length of the rod being equal to the radius of the bowl. (1885.)

Ans. $R_1 = \frac{1}{2}W$,

$R_2 = \frac{1}{2}\sqrt{3}W$,

where R_1 denotes the pressure on the bowl at B, W the weight of the rod, and R_2 the reaction of the hinge at A.

Ex. 6. Assuming the construction called the 'triangle of forces' show that if three forces are in equilibrium at a point each is proportional to the sine of the angle between the directions of the other two.

Draw a triangle (ABC) with its base (AB) horizontal and its vertex (C) downwards; let AC and BC represent threads fastened to fixed points at A and B, and at C to a third thread, which carries a given weight (W). Given the angles of the triangle ABC, find the tensions of the threads. (1890.)

Ans. Denoting the angle ABC by ϕ, and CAB by θ, also the tensions in the threads AC and BC by P and Q respectively, then

$$P = \frac{W \cos \phi}{\sin (\theta + \phi)}$$

$$Q = \frac{W \cos \phi}{\sin (\theta + \phi)}$$

Ex. 7. ABCD is a thread suspended from points A and D, and carrying a weight of 10 lbs. at B, and a weight, W, at C. The inclination to the vertical of AB and CD are 45° and 30° respectively, and ABC is an angle of 165°. Find, by construction or calculation, W, and the tension of BC. (1891.)

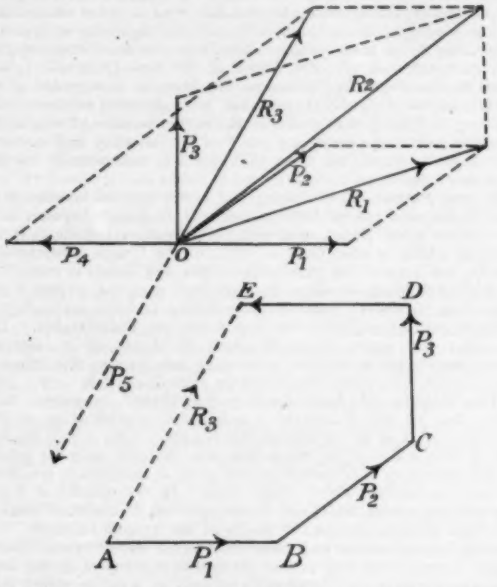
Ans. Let T denote the tension of BC.

Then $W = T = 27{\cdot}32$ lbs.

Ex. 8. Draw a triangle ABC, having an angle of 45° at B, and one of 30° at C. Let forces of 9, 7, and 4 units act from A to B, B to C, and C to A, respectively. By construction or otherwise, find their resultant completely, and show it in the same diagram as the triangle. (1898.)

Ex. 9. Draw an equilateral triangle ABC. A particle is moving with a velocity 3 from A to B, and afterwards with a velocity 2 from B to C. By means of a diagram drawn to scale, find the change of velocity in magnitude and direction. (1898.)

The resultant of any number of forces acting at a point can be obtained by repeated applications of the parallelogram law.



Let P_1, P_2, P_3, and P_4 denote four forces acting at a point O. Using the parallelogram, we can obtain the resultant R_1 of P_1 and P_2, then combine R_1 and P_3 to obtain R_2, and combining R_2 and P_4 we obtain R_3, the resultant required.

It will be found much better and neater to use the following construction :—

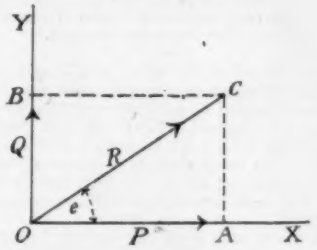
At any point A, draw AB parallel to and on any convenient scale equal in magnitude to P_1 ; from the end B draw BC parallel and equal to P_2, and similarly CD and DE parallel and equal to P_3 and P_4 respectively. The resultant of the four given forces is the line AE joining the starting point A to the final point E, and a force equal and opposite to AE or EA is the balancing force or *equilibriant*. If at O a force P_5 be applied, its direction parallel and its magnitude equal to EA, then the five forces P_1, P_2, P_3, P_4, and P_5, acting simultaneously on the point O, would form a system of balanced forces, or the point O would be in equilibrium.

Hence, when the magnitudes and directions of any given system of forces, acting at a point, are known, the resultant in magnitude and direction can be found by using a scale and a protractor. The graphic method also furnishes a ready check when the resultant is obtained by calculation.

Given two or more forces acting at a point, the process by which we are able to find a single force, the effect of which is the exact equivalent of the given forces, is called the *Composition of Forces*.

It is, however, often necessary to replace a single force by two forces in assigned directions. This is known as the *Resolution of Forces*.

The most important case is the resolutions of a force (or any number of forces) in two perpendicular directions.



Let a force R, acting at a point O, be represented in direction and magnitude to some convenient scale by a line OC ; draw through O a line OX, and a line OY perpendicular to OX.

If CA and CB be drawn perpendicular to OX and OY respectively, meeting OX at A and OY at B, the intercepts OA and OB are the resolved parts of OC along the two perpendicular lines (or axes) and are called the *rectangular components* of R ; these can be measured and thus their magnitude determined, denoting the angle AOC by θ.

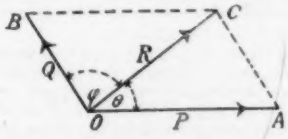
$$\therefore \frac{OA}{OC} = \cos AOC,$$

or $\quad OA = OC \cos\theta = R \cos\theta.$

Also $\quad OB = R \cos BOR = R \sin\theta.$

When R and θ are given, as the values of the sine and cosine of any angle are tabulated, the components OA and OB are easily determined.

By making use of the parallelogram law a force R can be resolved into two components along any two lines such as OA and



OB. Thus, if θ denote the angle made by OA with OC, and ϕ the angle made by OB with OC, and OC to any convenient scale be made to represent the number of units in R ; if CA be drawn parallel to OB, OA and AC to the same scale will represent the components P and Q,

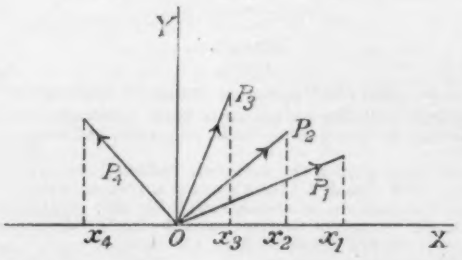
$$\text{or } \frac{P}{\sin\phi} = \frac{Q}{\sin\theta} = \frac{R}{\sin(\theta+\phi)}.$$

When θ, ϕ, and R are known, the quantities P and Q can be calculated. It may be advisable in many cases as a check on the calculation to obtain P and Q graphically.

To obtain the resultant of any number of forces, P_1, P_2, P_3, P_4, acting at a point O and represented in direction and magnitude by OP_1, OP_2, OP_3, OP_4.

Through O draw the rectangular axes OX and OY, and let fall perpendiculars on these lines as shown, then, denoting the components by X and Y,

$$\Sigma(X) = ox_1 + ox_2 + ox_3 - ox_4.$$
$$\Sigma(Y) = oy_1 + oy_2 + oy_3 + oy_4.$$



The lengths ox_1, ox_2, etc., can be scaled off or marked off on a slip of paper, care being taken that any distances to the left of OY or below the line OX are subtracted.

The two lengths so obtained can be used as the two perpendicular sides of a right-angled triangle ABC, where

$$AB = \Sigma(X) \text{ and } BC = \Sigma(Y).$$

Then R can be measured to the same scale and the angle θ measured by means of a protractor.

If the angles which P_1, P_2, P_3, P_4, make with ox are denoted by θ_1, θ_2, θ_3, θ_4, respectively.

Then

$ox_1 = P_1 \cos\theta_1$	$oy_1 = P_1 \sin\theta_1$
$ox_2 = P_2 \cos\theta_2$	$oy_2 = P_2 \sin\theta_2$
$ox_3 = P_3 \cos\theta_3$	$oy_3 = P_3 \sin\theta_3$
$ox_4 = P_4 \cos\theta_4$	$oy_4 = P_4 \sin\theta_4$

From the tables the numerical values of $\cos\theta_1$, $\sin\theta_1$, etc., can be inserted and the sum obtained. When $\Sigma(X)$ and $\Sigma(Y)$ are obtained,

then $\quad R^2 = \Sigma(X)^2 + \Sigma(Y)^2.$

Also $\quad \tan\theta = \dfrac{\Sigma(Y)}{\Sigma(X)}.$

The force equal in magnitude but opposite in direction to the resultant is called the equilibriant ; this, which makes $\Sigma(X) = 0$ and $\Sigma(Y) = 0$, gives the necessary conditions for equilibrium.

Example.—Find the resultant of three forces, P_1, P_2, P_3, of 4, 5, and 3 units respectively acting at a point o, the angle between P_1 and P_2 being 27° 26′, between P_2 and P_3 being 63° 17′.

Solution.—Taking the line P_1 as the axis of X and a perpendicular line as the axis of Y,

$$\Sigma P\cos\theta = 4 + 5\cos 27°\,26' - 2\sin 43'$$
$$= 8{\cdot}413.$$
$$\Sigma P\sin\theta = 5\sin 27°\,26' + 2\cos 43'$$
$$= 4{\cdot}303.$$
$$\therefore R = 9{\cdot}450. \qquad \theta = 27°\ 5\tfrac{1}{2}'.$$

(To be continued.)

German Expenditure on Education.—The State expenditure on education in Germany has increased during the last eight years (1890–97) by nearly £3,500,000. Of this increase £580,000 were spent on universities ; £320,000 on higher education ; £1,490,000 on elementary education ; £186,000 on art and science ; £107,000 on technical education. The chief item of increase was elementary education. The charge to the State under this heading was only £225,000 in 1871. In 1887–88 it had risen to £1,333,000. In 1890–91 charges were transferred from the Communes to the State, which then had to pay £2,900,000 towards elementary education, a sum which has risen since to £3,300,000. The State contributions are so organised that, while it bears the greater part of the charges for schools in the country districts, the town schools are made more than self-supporting.

☛ **Next Month we hope to publish Illustrated Notices of THE NEWEST GIFT-BOOK LITERATURE.**

MATHEMATICS,

STAGES 2 AND 3, SCIENCE AND ART DEPARTMENT.

BY G. A. BAXANDALL,

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Stage 2.

Algebra.

From the syllabus for this Stage we extract the following :—

'*Algebra*—Involution and Evolution. Surds. Quadratic equations, and problems producing them—Ratio, proportion, and variation.'

Before entering upon the work here indicated, we advise the student to work steadily for about a month at portions which come earlier. For example, he should, daily if his time permits, work one example on each of the three subjects—factors, simultaneous equations of the first degree, addition and subtraction of fractions, or simplification of expressions.

Work the following Examples :—

Hamblin Smith's Algebra, p. 47. Exs. 13 and 14 ; p. 148. Ex. 14 ; p. 149. Ex. 9 ; p. 140. Exs. 21 and 23.

Hall and Knight's Elementary Algebra, p. 111. Ex. 48 ; p. 119. Ex. 50 ; p. 82. Ex. 15 ; p. 171. Ex. 13 ; p. 143. Ex. 24 ; p. 146. Ex. 34.

C. Smith's Elementary Algebra, p. 102. Exs. 6, 18, 32 ; p. 134. Exs. 20, 24, 28 ; p. 80. Exs. 9, 16.

Involution.—It is only necessary to know, (1), how to square an expression containing any number of terms. (2.) How to cube an expression containing two terms. *Read* H.S. Chap. III. ; or H.K. Arts. 112–114 ; or C.S. Arts. 56, 58.

Evolution.—The rules for finding the square, cube or fourth root of an expression are clearly explained in H.S. Chap. XVII. and XVII. ; H.K. Chap. XVI. ; C. S. Art. 174.

The student does not require any special assistance here ; it is simply a case of learning rules by applying them sufficiently often in the working of Examples. There are numerous examples in the Chapters named ; the student must make a selection himself.

Example.—(*a*) Extract the square root of—

$$x^4 - 2kx^3 + (k^2 + 2)x^2 - 2kx + 1.$$

(*b*.) Extract the cube root of

$$x^6 + 12x^5 - 320x^3 + 3072x - 4096.$$

(Stage 2. May 1898. *Day.*

Ans. (*a*) $x^2 - kx + 1$; (*b*) $x^2 + 4x - 16$.

Trigonometry.

The syllabus for this branch of the work is as follows :—

'*Plane Trigonometry.*—Definitions. Measurement of angles by degrees and radians. The trigonometrical functions, and the conversion of one into another. Use of the positive and negative signs to denote contrariety of direction. Tracing of the trigonometrical functions in magnitude and sign through the four quadrants. The arithmetical values of the trigonometrical functions of 30°, 45°, 60°, 75°, 90°.

Logarithms.—Definition. Multiplication. Division and evolution by logarithms. The use of tables of logarithms and numbers, and of sines, cosines, etc., of angles. Tables of proportional parts for numbers and angles.

Triangles.—Solution of all cases of right angled and oblique triangles, and proofs of the requisite formulæ. Heights and distances. Area of a triangle.'

The length of the circumference of any circle contains the length of the diameter $3\frac{1}{7}$ times, or more nearly 3·14159 times ; which ever number we select we denote it by the letter π, hence the *semi*-circumference contains the *radius* π times.

If on the circumference of any circle two points be taken so that the length of the arc between them is $\frac{1}{360}$ part of the circumference, the angle which this arc subtends at the centre of the circle is called a *degree*.

If the length of arc between the two be taken equal to that of the radius, the angle subtended is called a *radian*.

These two angles, the *degree* and the *radian* are selected as the *units* in two different systems of measuring angles. The relation between their magnitudes is easily found, for a semi-circle contains the radius π times, therefore 180 *degrees contains* π *radians ;* hence a radian is $\frac{180}{\pi}$ degrees, which works out to be nearly 57·29 degrees.

When we say that an angle is $2\frac{1}{2}$, we mean $2\frac{1}{2}$ radians, *i.e.*, $2\frac{1}{2} \times \frac{180}{\pi}$ degrees.

Learn the definitions of the six *trigonometrical ratios* or *functions*, as they are called. (See Text Books) H.K. p. 6 ; H.S. p. 32 ; 'Lock' p. 46 ; 'Loney' p. 19. Observe that the *squares* of sin A, cos A, etc., are written $\sin^2 A$, $\cos^2 A$, etc.

Work the following examples :—

1. Draw, as accurately as you can, a triangle having angles of 30°, 60°, and 90° ; also draw one having angles of 45°, 45°, and 90°. It is an easy matter to *prove* that the sides opposite the angles in the former triangle, taken in order, are in the ratio of 1, $\sqrt{3}$, 2, and in the latter, 1, 1, $\sqrt{2}$.

(i) Write down, from the definitions, the numerical values of the six trigonometrical ratios of the angles 30°, 60°, 45°.

(ii) Write down the values of—

$\sin^2 30° + \cos^2 30°$; $\sin^2 60 + \cos^2 60°$; $\sin^2 45° + \cos^2 45°$

and reflect on your answers.

(iii) Write down the values of the six quantities—

$$\left.\begin{matrix} 1 + \tan^2 30° \\ \sec^2 30° \end{matrix}\right\} ; \quad \left.\begin{matrix} 1 + \tan^2 45° \\ \sec^2 45° \end{matrix}\right\} ; \quad \begin{matrix} 1 + \tan^2 60° \\ \sec^2 60° \end{matrix}$$

Also work the following :—

H.S., p. 61, Exs. 1, 3, 4, 6, 10, 13 ; p. 49, Exs. 1, 3. 5, 7.

H.K., p. 11, Exs. 1, 7, 12 ; also p. 27, Exs. 4, 5, 11.

'*Loney*,' p. 31, Exs. 6, 7, 9, 11.

'*Lock*,' p. 52, Ex. 8 ; p. 60, Exs. 2, 6, 10 ; p. 75, Exs. 1, 3, 6, 7.

Stage 3.

Algebra.

From the syllabus of this stage we take the following :—

'*Algebra.* Permutations and combinations. Progressions. Complete theory of indices. The Binomial Theorem.'

It should be understood at the outset that questions are set on portions of the subject which do not come under any of these heads. It would be difficult indeed to include every thing in the syllabus. We have not space for special remarks on such portions, but we shall refer the student to articles in various text books which he should read. If he has an opportunity of consulting more than one text book on algebra we advise him to avail himself of such. It often happens that what one author states vaguely, another will explain very clearly.

Two or three times each week the student should select, and work, examples on such portions of the subject as—simultaneous quadratic equations, roots of quadratic equations, harder factors, etc.

We shall now draw attention to some articles and chapter which the student ought to read at some period or other, as his time permits. Consider carefully any worked-out examples which appear in the text books.

Hall and Knight's 'Elementary Algebra.' Work examples from Chap. XXVI., Arts. 210 to 219 ; 222 to 230 ; Chap. XXXVI. should be carefully read ; Chap. XXXII. with remarks on commensurable and incommensurable quantities.

Hall and Knight's 'Higher Algebra.' Chap. IX. very thoroughly; Chaps. I., II., III. ; Arts. 514, 518 to 523 should be read at a later date.

Todhunter and Loney, 'Algebra for Beginners.' Chap. XXV., Chap. XXXI. very thoroughly ; Chaps. XXXII., XXXIII., XXXIV ; Chap. XLIII. contains much that is important.

C. Smith, 'A Treatise on Algebra.' Chap. XVI. ; Arts. 86 to 94 ; Arts. 121 to 128.

'*Intermediate Algebra*,' *Briggs and Bryan.* (This book appears to just cover the work for Stage 3. and no more). Arts. 63, 66, 67, 88 to 93, 95, 96, 100, 108, 123 ; Chaps. VIII. and IX., Chap. XI., Chap. XII. and XIII. very thoroughly.

Trigonometry.

The syllabus for this branch of the work is as follows :—

'*Plane Trigonometry.* Formulæ for finding the sine, cosine, etc., of the sum and difference of two angles, and of the multiples and submultiples of an angle. Diameters of circles inscribed in and circumscribed about a given triangle. Areas of regular polygons incribed in and circumscribed about a given circle.. Area of a circle. Description and use of the vernier and of the theodolite and sextant.'

At least one month may be profitably spent in working at the chapters now mentioned.

Hall and Knight's 'Elementary Trigonometry,' Chaps. XI. and XII.

Loney's 'Trigonometry,' Part I., Chaps. VII., VIII., and IX.

Lock's 'Elementary Trigonometry,' Chaps. XI., XII., and XIII.

Todhunter's 'Plane Trigonometry,' Chaps. VI. and VII.

As many examples should be worked as the student can find time for. All the proofs, geometrical or otherwise, should be carefully studied. There is probably no portion of the subject so important as that dealt with in the above chapters.

The Teacher's Greatest Need.

If there be any single thing in the equipment of a teacher which approaches to an absolute necessity, it is a fine reference library. Such are the demands upon the teacher of to-day that without such a library he is almost lost. Nowadays a teacher is expected to know a little something of practically everything, and furthermore, to know this accurately and to be able to impart his knowledge to another's mind.

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HEAT,
WITH SPECIAL REFERENCE TO ELEMENTARY THERMODYNAMICS.

BY EDWIN EDSER, A.R.C.S., F.PH.S.

It will now be possible to obtain an expression for the ratio of the specific heats of a gas, in terms of quantities involved in the Dynamical Theory. The problem we are about to consider is not generally solved in elementary works on heat, but the reasoning employed is extremely instructive, and will help to render the student familiar with the methods of attacking a great number of similar problems.

According to the Dynamical Theory, all problems connected with the heating or cooling of gases may be solved in terms of the motions of the constituent molecules. In fact a hot body differs from a cold one chiefly in this, that its component molecules are in a state of more violent agitation. In a gas the molecules are capable of moving from place to place in the containing vessel; indeed the only thing which restrains any particular molecule from moving quite freely from one position to another is the frequency of the collisions which take place. In a liquid, owing to the molecules being very much nearer to each other than in the gaseous state, collisions are very much more frequent, and consequently any particular molecule can only move from place to place much more slowly. In a solid each molecule must be considered to continually vibrate about a near position, and therefore, to be practically incapable of continuously changing its position.

HEATING A GAS, THE VOLUME REMAINING CONSTANT.

The kinetic energy of a particular gas molecule is equal to $\frac{1}{2}MV_1^2$, where M is the mass of the molecule, and V_1 is its velocity at any instant. If V^2 be taken as the average value of the square of the velocity of the molecule (*i.e.* the *mean square of the velocity* of the molecule), then the average kinetic energy of this molecule will be equal to $\frac{1}{2}MV^2$. Further, since the relation between a quantity of heat Q, and the amount of work W which might be performed therewith, is expressed by

$$Q = \frac{W}{J}$$

where J is Joule's equivalent, it is obvious that the energy possessed by the molecule under consideration may be expressed in heat units as equal to

$$\frac{\frac{1}{2}MV^2}{J} \text{ calories.}$$

If there are N similar molecules in any given quantity of gas (for simplicity say one gram) then the heat equivalent of their total energy will be equal to

$$\frac{\frac{1}{2}NMV^2}{J} \text{ calories.}$$

Further, if T be the temperature of the gas (measured from the absolute zero, as previously defined) then it is plain that the heat necessary to raise the temperature of one gram of the gas by one degree centigrade will be given by

$$\frac{\frac{1}{2}NMV^2}{JT}.$$

This expresses the heat equivalent of the *molecular energy*, *i.e.* the heat which would correspond to the energy of N hard and perfectly elastic molecules each possessing, at the temperature T, an average kinetic energy equal to $\frac{1}{2}MV^2$ ergs. But heat may be used up in imparting relative motions to the atoms composing a molecule. Further, if there be any attractive force between the atoms composing a molecule, then heat might be absorbed in merely separating these atoms as the temperature was increased. It is even conceivable that heat might be absorbed in imparting relative motions to the various parts of a single atom; this would happen if it were possible to set an atom vibrating after the manner of a bell which is set ringing at the same time being subjected to bodily motion. Though spectrum analysis indicates that atomic vibrations, such as the latter, in all probability are produced, at least at very high temperatures, yet under ordinary circumstances we are justified in assuming that by far the greater portion of the energy of a molecule which is not due to its bodily motions may be ascribed to the relative motions of the atoms within the molecule. Call his energy of a single molecule E. Then the SPECIFIC HEAT OF A GAS AT CONSTANT VOLUME may be represented by

$$\frac{1}{JT}(\tfrac{1}{2}NMV^2 + NE) \quad \ldots\ldots\ldots\ldots \quad (1)$$

It may be noticed that in a gas whose molecules are *monatomic*, E would, according to the assumption made above, be equal to zero.

HEATING A GAS, THE PRESSURE BEING MAINTAINED CONSTANT.

When a gas is heated under conditions of constant pressure, additional heat, over and above that already specified, must be supplied in order to perform work against the external pressure p. Suppose one gram of the gas to be contained within a cylinder closed at one end and fitted with a gas-tight piston, of area A, which is capable of motion along the cylinder without any frictional resistance. Then the force acting on the piston will be equal to pA dynes, since the pressure p is measured in dynes per square centimetre.

If we start with the gas at zero on the Absolute Temperature scale, its volume will be negligeably small. If v be the volume of the gas at a temperature T, then the piston must have been moved along the cylinder through a distance x, such that xA $= v$. Since the pressure P remains uniform during the expansion, the work performed

$$= p\text{A} \times x = pv.$$

But it was shewn in the first of the present series of articles that for a perfect gas

$$pv = \tfrac{1}{2}NMV^2.$$

Therefore the external work performed whilst the gas is heated from the absolute zero to a temperature T is equal to

$$\tfrac{1}{2}NMV^2.$$

This work corresponds to a quantity of heat

$$\frac{\frac{1}{2}NMV^2}{J},$$

which must have been supplied by neighbouring bodies.

Experiments have been described which shew that only a very small amount of heat is used up during the expansion of a gas, in overcoming the attractive forces exerted or any molecule by the neighbouring molecules. Hence we may write the SPECIFIC HEAT OF A GAS AT CONSTANT PRESSURE as equal to

$$\frac{1}{TJ}(\tfrac{1}{2}NMV^2 + \tfrac{1}{2}NMV^2 + NE) \quad \ldots\ldots \quad (2)$$

The ratio γ of the specific heats of a gas, at constant pressure and at constant volume respectively, may therefore be written

$$\frac{\frac{1}{TJ}(\frac{1}{2}NMV^2 + \frac{1}{2}NMV^2 + NE)}{\frac{1}{TJ}(\frac{1}{2}NMV^2 + NE)} = \frac{\frac{1}{2}NMV^2 + \frac{1}{2}NMV^2 + NE}{\frac{1}{2}NMV^2 + NE}.$$

It has previously been pointed out that for a monatomic gas E may be taken as equal to zero. In this case

$$\gamma = \frac{NMV^2(\frac{1}{2} + \frac{1}{2})}{\frac{1}{2}NMV^2} = 1 + \tfrac{1}{2} = 1{\cdot}666 \ldots.$$

This is a most valuable relation, because, as will subsequently be shown, the value of γ may be determined from the velocity with which sound travels in a gas. Hence, if in any case γ is found to be equal to 1·666, we may conclude that the gas is monatomic, *i.e.*, that each molecule comprises only a single atom. Further, according to Avogadro's hypothesis, equal volumes of all gases contain the same number of molecules. It therefore becomes possible, from a determination of the density, to directly deduce the atomic weight of the element whose atoms compose the gas. Thus Lord Rayleigh and Professor Ramsay relied chiefly on reasoning similar to the above, in ascribing a monatomic structure to the gas Argon. Professor Ramsay subsequently found Helium to possess a value of γ equal to 1·66, which led him to conclude that Helium also was monatomic. More recently Professor Ramsay and Mr. Travers have found that Krypton, Neon, and Metargon (their recently discovered constituents of atmospheric air) also had a value of γ equal to 1·66. It is, however, a most peculiar circumstance that the prismatic spectrum of Metargon coincides almost identically with the well known carbon spectrum. This alone would lead us to believe that Metargon is really some compound of carbon. On the other hand, the value of γ points to a monatomic structure of the gas, which would, of course, preclude its being a compound of any sort.

Exercise 1.—Calculate the value of the specific heat of hydrogen when heated under conditions of constant volume.

The specific heat of hydrogen, under the supposition that E is negligeable, will be equal to

$$\frac{\frac{1}{2}NMV^2}{JT}$$

Also, from the expression

$$pv = \tfrac{1}{2}NMV^2$$

we can calculate the value of $\frac{1}{2}NMV^2$, remembering that when p is equal to the atmospheric pressure, measured in dynes, v will be the volume of one gram of hydrogen, which is known when the temperature is O°C. In that case, recollect T = 273°, J = $4{\cdot}2 \times 10^7$ ergs per calorie. The subsequent calculation is quite straighforward, and may be left as an instructive exercise to the student.

Exercise 2.—Calculate the specific heat of oxygen, when heated under condition of constant volume, assuming E to be zero.

Exercise 3.—It is sometimes stated that the products pv represents the *volume energy* (*i.e.*, energy corresponding to a volume v, at a given temperature) of a gas. How far is this statement accurate?

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Racine's characters are abstractions rather than creatures of flesh and blood: sketches in outline, not profound studies of human nature. He depicts a virtue, he does not paint a man. He is the very opposite of Shakespeare, whose piercing and receptive insight sees at a glance the body and mind, the past and present, the nature and nurture of the creature of his brain and the tangled skein of the numberless varied and varying threads that interlace to form it. Racine takes one (ruling) passion—pride, anger, overpowering jealousy, conjugal faithfulness, modesty—and gives it 'a local habitation and a name.' This passion personified, nothing else and nothing more, is the character. It can be drawn with a single line. None of the minor features which add complexity to nature's work are to be found. In the same way the frequenters of Rambouillet House used to account for different sorts of men—the jealous, the fickle, the obstinate, the noble-minded, and the treacherous—and La Bruyère was wont to explain the 'self-made man,' the admirer of the sex, the hypocrite, and the courtier. The intellect of the age was oratorical, and busied itself everywhere in deducing consequences from isolated qualities. Its characteristic, indeed, was the elucidaton of abstract ideas, and these its poets introduced on the stage and its prose writers into their portrayals of characters. This is why it finds its natural expression in heroic and elevated characters. It endows them with its own fundamental qualities. It makes them embodiments of nobleness, of generosity, of virtue, that is to say, of reason put into practice. It recognises passion only as a subordinate force and capable of subjection. Disorder and folly it taboos. Excess and baseness it rejects. Vulgar and repulsive rascality, even in the case of a villain, it finds intolerable, and insists on at least the appearance of moderation and propriety even in him. It would fain find some shadow of itself even in places where the substance is absent.

A Prize of One Guinea will be given for the best translation into English of the following extract :—

Les habitants de ce pays-ci ont beaucoup d'esprit, trop de vivacité, une inconstance de girouettes; cela vient, je crois, des vicissitudes de leur atmosphère, qui passe en vingt-quatre heures du froid au chaud, du calme à l'orage, du serein au pluvieux. Il est impossible que ces effets ne se fassent pas sentir sur eux, et que leurs âmes soient quelque temps de suite dans une même assiette. Elles s'accoutument ainsi, dès la plus tendre enfance, à tourner à tout vent. La tête d'un Langrois est sur ses épaules comme un coq d'église au haut d'un clocher; elle n'est jamais fixe dans un point; et si elle revient à celui qu'elle a quitté, ce n'est pas pour s'y arrêter. Avec une rapidité surprenante dans les mouvements, dans les désirs, dans les projets, dans les fantaisies, dans les idées, ils ont le parler lent. Pour moi, je suis de mon pays; seulement le séjour de la capitale et l'application assidue m'ont un peu corrigé. Je suis constant dans mes goûts; ce qui m'a plu une fois me plaît toujours, parce que mon choix est toujours motivé: que je haïsse ou que j'aime, je sais pourquoi. DIDEROT.

GERMAN COMPETITION.

RESULT OF THE OCTOBER COMPETITION.

The prize is awarded to *Agasnog*, the pseudonym of Miss Annie Keatings, St. John's Priory, Banbury.

First Class.—Sedgemoor, Mahomet, Westward Ho! Barbarossa, Garnet, Fessus rerum, Day dawn, C.E.M., Andromaque, Kish, M.F.C., E.S., Thundergay, Grund, Godesberg, Dies, Polly, Leute, Fritz, O Mimosa San, Ladybird.

Second Class.—Tanno, Granny, Hyacinthe, A. Loreburn, Marmion, Hajji Baba, Thomas à Becket, D. Fense.

Prize Translation.

But when the conversation between the two travellers turned on some recent events and on politics, a subject was broached of intense interest to the Suabian. The outward form and the inward strength of Germany were discussed. With a certain bitterness he (the Suabian) drew a parallel between now and formerly, which did not precisely give the preference to recent times. The traveller from Brandenburg, whose principles did not coincide with those of his companion, nevertheless agreed, though not without some twinges, with his last dicta. Unhappily, however, the expression, 'I am a Prussian,' with which he started, incensed, without any intention on his part, his companion still more. This latter now forgot every restraint of prudence. With an eloquence that in other places had been serviceable and persuasive, he sought to impose his own views, and nothing was too high to be reduced to his own scale.

The Prussian, who only knew such as he from hearsay, was dismayed by his utterances. Might not the postilion, might not even a traveller in the inside of the vehicle, have heard these speeches! Spandau, Kopenick, Jülich, and every possible fortified place, passed before his excited fancy, and it seemed to him that the best way to reduce his companion to silence was to slink into a corner and feign sleep.

A Prize of Half a Guinea will be given for the best translation into English of the following extract :—

Petits-Crevés—so nennt die neufranzösische Kunstsprache bekanntlich jene mehr oder minder lächerlichen Hanswurste, die keine höheren Bestrebungen kennen, als die Sorge, sich nach der neuesten Mode zu kleiden, im Café Riche zu diniren, Cigarren zu einem Franken das Stück zu rauchen, und Pferde und Hunde zu halten. Es gibt Petits-Crevés, die mit der Zeit zu Besinnung kommen, und die jockey-clubliche Nichts-und-Wieder-Nichts-Existenz an den Nagel hängen, um vernünftige Menschen zu werden; allein diese seltenen Ausnahmen sind nie rechte Petits-Crevés gewesen.

Sie haben den Stutzer nur aus genialischer Launenhaftigkeit gespielt, wie Prinz Heinz von England das *mauvais sujet* copirte; oder sie waren Petits-Crevés aus Pflichtgefühl gegen die Gebote des *chic*—ohne sich jedoch in ihrem Petit-Crevismus recht wohl zu finden. Im Allgemeinen ist und bleibt der Petit-Crevé ein jämmerlicher Tropf, an dem Hopfen und Malz verloren ist.

Im Café Tortoni sitzt ein junger Mann, dessen Leibwäsche ist von tadelloser Reinheit und Feinheit; seine Jaquette sitzt wie angegossen; mit wohlgepflegten Fingern, deren Spitzen von langen rosigen Nägeln überragt sind. Der junge Mann ist Monsieur le Baron Benjamin Vaurien. ERNST ECKSTEIN.

N.B.—Do not translate Petits-Crevés into English.

REPORT ON THE PRIZE COMPETITIONS FOR OCTOBER.

The French piece presented some difficulties in translation, although its leading idea is easily grasped. For the purpose of further exemplifying the fundamental difference between the personages of Racine's dramas and those of Shakespeare, Taine shows how the literary coterie of the Hôtel de Rambouillet and La Bruyère endeavoured to classify men rigidly according to the virtue or vice which dominated their natures, and to explain the characteristics of each class of men so formed. A great many competitors did not bear this in mind, and translated *le jaloux*, etc., by their corresponding abstractions. The antithesis between *la raison oratoire* and *la raison pratique* was somewhat difficult to follow. The context shows that the former refers to the rhetorical and didactic reasoning of the prose writers and poets of the age, whilst the latter is reason applied to life. It would have been better to have kept to the future in translating *La Bruyère montrera*. The famous *Caractères* of La Bruyère did not appear until Racine had written most of his great dramas. In spite of the difficulties of the piece, the average merit of the translations is decidedly high.

The large number of those placed in the First Class in German is a proof of the general high quality of the renderings sent in. The only word which proved a general stumbling-block was *Gestalt*. The word is not very definite. It means the manner in which the German Empire is built up of various states.

☞ **Several Competitors were disqualified this month under Rules 2 and 3.**

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THE CO-OPERATIVE TOURIST IN EXCELSIS—HISTORY IN ROMANCE.

MR. WOOLRYCH PERowne'S name inevitably suggests Dr. Lunn, the Reunion of Christianity, and the Co-operative Tourist. The Co-operative Tourist, who has now a summer lease of Switzerland, appears to differ from the much-maligned species of Cook in that he requires lectures at the close of day. But Switzerland is, so to speak, used up, and the Alexanders of Endsleigh Gardens are panting for fresh worlds to conquer. Their latest development is a seven weeks' tour into Central Asia with three days at Bokhara. Within the years of discretion of a middle-aged man the wild Tartar steppes of Khiva, Bokhara, and Samarcand were as inaccessible and mysterious as the abode of the Grand Lama of Tibet is to-day. Vambéry in 1863 had to disguise himself as a dervish in order to visit these states. Capt. Fred Burnaby carried his life in his hand as he rode to Khiva, and now, the Co-operative Tourist calmly buys his railway ticket for Bokhara, and is careful to take his dress suit along with him! 'Russian Hosts and English guests in Central Asia,' is the title of Mr. Perowne's record of the first 'personally conducted' tour ever made over the Transcaspian Military Railway in Russian Central Asia. Mr. Perowne disclaims any intention of writing either a guide book or a politico-geographical volume. He simply desires to produce a memento of a journey that was quite unique. Such a book, of course, is exempt from criticism. It pretends to no graces of style, to no original views, to no fresh investigations. And yet Mr. Perowne cannot disguise the fact that he is a remarkable man. He took a mixed party of twenty-five ladies and gentlemen, and housed them in a train for several weeks, and yet nowhere is the slightest evidence of that malice, hatred, and all uncharitableness which a prolonged voyage is fated to engender.

TYPES OF TURKMANS.

* * * * *

The tourists assembled at Constantinople and proceeded by Russian steamer to Batoum, calling on the way at Trebizond. At Batoum the party was treated to the first of that series of public receptions which punctuated its way across Asia. The journey from Batoum to Baku, the town of naphtha, was broken at Tiflis, which Mr. Perowne found far inferior in picturesqueness to Berne or Interlaken, and inexpressibly duller than either.

From Tiflis an uninteresting railway journey of nineteen hours brought the tourists to the shores of the Caspian. Here is a description of Baku :—

'THE OIL FOUNTAINS OF BAKU.

'We steamed into Baku about 6 a.m. in the struggling light of a November dawn. We passed through what looked in the ghostly light to be forests of fir trees, and I thought that perhaps here was a town with sea, cliff, and woods, but these notions faded with the rising sun. Baku in the glare of daylight is a dismal place; the buildings are mean, the streets very bad, and the surrounding country dispiriting to a degree. Our fir trees turned out to be the conical wooden erections put up over the naphtha wells to prevent a "fountain" wasting its precious contents by watering the neighbouring acres. They also contain the derricks which support the boring and pumping gear. There are hundreds of these all round Baku, and at a distance they look exactly like trees. We had the good luck to witness one of these "fountains" on the day of our arrival. The Anglo-Russian Petroleum Company had "struck ile," and a spout began which was still running there three weeks later on our return. In old days a fountain was a double nuisance. The unlucky owner had to pay all sorts of damages for injuring his neighbour's property, and he at the same time lost thousands of gallons of the precious stuff. By building these conical wooden chimneys over a well, the spout is at least confined, and the only thing to do is to try and save as much as possible. Of course, preparations are always made in case a "fountain" bursts out, but rarely does it happen that the first rush can be properly coped with. It is far more profitable to have no fountain and to rely on pumping. . . . . About nine miles from the town of Baku is the Balakhani-Sabvontchi Plateau, the principal oil-producing area of Baku, and a visit to the wells there is incumbent on every traveller who would study the subject of Russian petroleum. There are, indeed, other oil-producing wells in other directions round Baku, but none so interesting both in point of number and antiquity. Balakhani can be reached by carriage or train. . . . The country traversed is as bare as a billiard-table and as rough as a mountain side. . . . Nearing Balakhani one sees lakes of salt and of crude petroleum, interminable pipe-lines leading to Surakhani, where are the distilleries, reservoirs full of the precious liquid that means gold to English investors, disused watch-towers, formerly built to protect the pipe-lines from infuriated Tartar cart-drivers, whose gains were extinguished by the laying of these lines, and last, but not least, the forest of conical wooden erections built to cover the derricks erected over every naphtha well. . . . Oil is, of course the motive power of everything out here: engines on the railway—and very curious some of them are, with a funnel at each end and a cab in the middle—steamers on the Caspian and Black Seas—machinery in the towns.'

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long-distance train, was in waiting, and officers in the suite of General Kouropatkine, then Governor-General of the province, now Minister of War in St. Petersburg, were in attendance to conduct the party to the seat of his government

PRAYER-TIME IN A BOKHARA MOSQUE.

at Ashabad. The train was found to be comfortably, almost luxuriously appointed, and the meals were good, with the exception of the meat, which was, as Mr. Perowne says, 'as poor as that of Jerusalem.' The journey across the desert to Geok-Tepè, where the fierce Tekke-Turkmans made their last stand against the Skobeleff, occupied the night. A band of subdued Turkmans, headed by their *starshina* or head-man, was drawn up at the station. The men wore their usual dress, a sort of dressing-gown of a dull red with small black stripes, high leather boots, and a great sheepskin hat. At Ashabad, the capital of the province, General Kouropatkine showered favours on the tourists. He showed them the 'lions' of the district, held reviews, and gave receptions in their honour. Mr. Perowne has no words to do justice to the noble hospitality which was extended to his party. Merv, with its huge fort, its Kibitkas, its university, its flute players, and its Cossacks, was the next halting place, and then, Bokhara.

'In Bokhara, the Noble.

'To those who have only visited the Europeanised East, Bokhara is a revelation . . . . Our green and red-striped guides cleared the way for us in the most summary fashion with their whips until we reached an open space containing two rather tumbled-down Medresses or universities. Of the public buildings in Bokhara there is not much to say except that they want repairing very badly. The huge and meaningless arched porticoes give no repose to the eye, and when one knows that they not only look, but really are, architectural shams, they begin to have an absolutely ugly appearance, especially in their state of disrepair. Covered, as all these buildings, with their domes, arcades, and arches, once were with lovely turquoise enamel, the traveller may well have marvelled at their beauty, but now in their decay, covered as by a tattered garment, with the mere shreds of their former beauty, one fails to appreciate them, and I venture to think rightly, too, even at the cost of being thought a Philistine. . . . As we passed through the precincts of a mosque it happened to be the hour of mid-day prayer, and we were fortunate enough to see the most picturesque sight. Outside the doors of the mosque the stone flags of the pavement were covered with devout Moslems engaged in prayer; through the low archway leading into the mosque we could see that the inside was packed quite full, and these worshippers outside were compelled to perform their prayers under the open sky. It is always an interesting sight to watch any body of Mohammedans at their prayers. So exactly do they fulfil the regulations of the Prophet that it is possible for several hundreds to take their time from a leader, and, like a regiment of soldiers doing physical drill, to proceed through the whole gamut of genuflexions and prostrations, which are inseparable from their prayers. On the present occasion the surroundings helped the scene. As we looked there was the portal of the mosque on our left, the white-turbaned many-coloured group of worshippers in front of us. On our right was one of those pools, so common in Bokhara, overshadowed by mulberry trees, and surrounded by booths, in which were displayed all sorts of fruit and vegetables, and in front of which was ever passing an endless stream of men and women, conspicuous among whom are a string of five or six Dervishes in their conical hats, begging alms and chanting as they go.'

Samarcand was found to be the unspoiled veritable East, full of noble historical monuments, now unhappily past restoration or repair. From Samarcand the party returned to the Caspian by the way it came, receiving at Ashabad renewed evidences of the Governor's good will. Mr. Perowne is frankly a Russophil, and is full of hearty admiration for the splendid energy which has swept out of existence the horrors of a vile and universal slave traffic, has thrown the iron line of civilization across a thousand miles of territory, and now bids fair by skilful administration to restore the Saturnian reign to Central Asia. 'An empire,' he says, 'worthy of Timur or of Alexander is rising into existence.'

A plain tale, plainly told, Mr. Perowne's book is, nevertheless interesting throughout. A word of praise is due to the many capital reproductions of photographs taken on the journey. By the kindness of the publishers I am permitted to insert some specimens in this article. The Co-operative Tourist has penetrated Central Asia. He will not stop there. It cannot be long before *Punch's* prophecy is fulfilled, and we are invited by tempting circular to spend our Easter at Talienwan!

* * * * * *

Some months ago I called the attention of my readers to the admirable series of Historical Novels which Mr. G. L. Gomme is editing for Messrs. Constable. The design of the series is to make romance the handmaiden of history. Lord Lytton's 'Harold,' Macfarlane's 'Camp of Refuge,' and Kingsley's 'Westward Ho!' have already been published. The latest addition is Macfarlane's 'Reading Abbey,'* which, though not a great story, is an exceedingly faithful picture of the troublous reign of Stephen of Blois. Mr. Gomme has furnished an illuminating introduction and a sufficient supply of notes. The reproduction of coins, seals, heraldic devices, arms and costume, are a distinct feature of the volume. I

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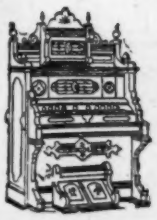

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DURING the past few years some very important, valuable, and costly works have, in various ways, been brought within the reach of book-lovers of moderate means. Sometimes this has been done by a reprint on cheaper paper, as in the case of the **Encyclopædic Dictionary**, issued by the publishers of the *Daily Chronicle*. Often it has been the result of the development and improvement which is continually going on in the material production of books. Sometimes, as in the case of the subject of this short paper, the increased cheapness is due to the simplification of business arrangements, and consequent decrease in the cost of distribution, coupled with increase in the demand.

About two years ago the *Times* issued to the public an excellent **Atlas** at a price extremely low for such a high class production. The moderate price was possible, because the publication was sent direct to the purchaser without the intervention of the middleman. The success of that venture was so marked, that the *Times* proprietors have now undertaken another similar enterprise on a much more extensive scale. This is no less than the direct issue of a reprint of the latest edition of the most comprehensive work of reference in the English language, the **Encyclopædia Britannica**, at a price considerably less than half the original published price.

Many of our readers have probably, like ourselves, found the advantage of referring to volumes of this great work in public libraries. To them will have been manifest not merely the great usefulness of the book for purposes of reference, but also the attractive and readable style in which matters are presented in its articles.

For those not acquainted with the **Encyclopædia Britannica**, a few descriptive details may be of interest. The first edition was published in 1771, and since then successive editions have been issued at intervals until the latest—the ninth edition—which was commenced in 1875, and completed in 1889. It consists of 25 large volumes in demy quarto, the last of which contains an elaborate index of the 16,000 articles included in the other 24. Each of these volumes measures 11¾ inches in height, 9¼ inches in depth, and 2½ inches in thickness, and contains nearly 900 pages. The whole work includes 30,000,000 words of letterpress, printed on 22,000 pages, besides 338 full page plates, and 671 maps and plans, many of the plates and maps being coloured. There are also 9,000 other illustrations in the text.

A pamphlet now lying before us contains specimen pages, plates, and maps, which prove that the paper and typography are of the highest quality. But, after all, the most striking merits of the work are not its comprehensiveness, nor the excellence of its material production. The articles have been written by the greatest experts of our time in science and art, in history and literature. This fact it is which makes the work not only thoroughly trustworthy, but eminently readable. A sheet, containing twenty long columns, furnishes the titles of two thousand of the articles, with the names of the writers, and from it we learn that amongst the contributors are Matthew Arnold, J. Addington Symonds, R. Louis Stevenson, Austin Dobson, Algernon C. Swinburne, Andrew Lang, and a host of men of letters of high rank; Lord Kelvin, Lord Rayleigh, Sir R. Ball, Sir Arch. Geikie, Sir W. Crookes, Professors Huxley, Ray Lankester, Dewar, Sir F. Abel, and many of our most famous scientists; the Bishop of London, Dean Bradley, Dean Farrar, H. R. Haweis, Lord Grimthorpe, Professor Skeat, Mrs. Fawcett, and hundreds of specialists—the total number of writers being eleven hundred. From the names mentioned it will readily be understood that this work is by no means a mere collection of dry details of special information, but a treasure house of living literature. To own it is to have possession of the realm of learning. Some of the articles extend to nearly two hundred large pages, and are really admirable monographs on the subjects of which they treat.

It has been calculated that the letterpress would fill three or four hundred ordinary volumes, and that it would be scarcely possible to select a thousand other volumes which would afford all the information to be found in these twenty-five. Having regard to the amount of literary matter, and the high standing of the writers, we need not be surprised to learn that the cost of the manuscript was £60,000, and that the total cost of producing this ninth edition was about £200,000.

Now by the plan to which we have referred, the *Times* proprietors have made arrangements with the original publishers, Messrs. A. and C. Black, under which the set of 25 volumes, suitably bound in cloth, and in every respect equal to those originally sold for £37, are offered for £16. For the convenience of those who would find it inconvenient to pay this amount at one time, payment will be received in sixteen monthly instalments of one guinea, and the set will be delivered before the second instalment is paid. The set, half bound in maroon morocco, has hitherto cost £45, but under this plan may be obtained for £20, or for twenty monthly payments of a guinea. The price of a set in full morocco with gilt edges is £27, or by instalments 27 guineas instead of £65.

We cannot go quite so far as the advertisers in saying that there is no teacher who cannot afford on such easy terms to purchase this complete reference library for his home; but there must be many teachers and lovers of knowledge who would find it worth their while to invest in such a valuable work. For a further cost of three pounds a handsome revolving bookcase, substantially made of oak and fitted to hold the set of volumes is obtainable. A visit to the *Times* Office has given us the opportunity of examining this convenient piece of library furniture, as well as the volumes of the Encyclopædia bound in the various styles we have mentioned.

Such favourable terms of purchase having been arranged, no public library should remain without a copy of this great work of reference; and teachers who have influence in such institutions will no doubt use it to secure attention to this matter. The libraries connected with our Polytechnics, with our Training Colleges, and with Pupil Teacher Centres, might well profit by this unrivalled opportunity of adding to their usefulness.

BOOKS, SMALL AND CHEAP.

From the *Reviews of Reviews* Office we have received a number of specimens of the admirable Penny Series, edited by Mr. Stead, for the use of schools, of young people, and working men. Amongst them are a selection of six of Lambs' **Tales from Shakespeare**, and a well-printed edition of **The Merchant of Venice.** These and four numbers of **Poems for the Schoolroom and the Scholar**, selected by Mr. R. S. Wood, appear to be extremely well adapted for use in Evening Continuation Schools as well as in Day Schools.

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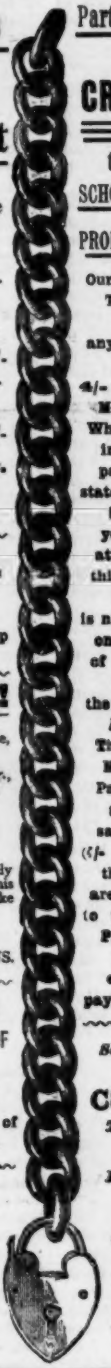

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The Reign of Elizabeth. By C. S. Fearenside, M.A. (Oxon.) The special period of history set for the scholarship candidates sitting in December 1899 is the reign of Elizabeth, hence the issue of this book, which is a reprint from the second volume of the 'Intermediate Text-Book of English History,' a fact that did not prejudice us in favour of the book as a guide to the scholarship examination. A careful perusal of the various chapters, however, convinced us that it would be very difficult indeed to select a book more likely to achieve its object than Mr. Fearenside's 'Reign of Elizabeth,' which we advise scholarship candidates to see before deciding which book they will rely upon for this important part of their examination.

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The School Board Chronicle Edition and Manual of the Code for Evening Schools, 1898-9. Edited by Herbert Cornish. This fifth issue of an excellent annotated handbook to the Evening School Code provides a collection of trustworthy information which cannot fail to be of the greatest use to managers and Teachers of Continuation Schools, which are now being so vigorously developed. For several years past we have proved this to be an invaluable work of reference, and have pleasure in warmly commending the manual to our readers.

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THE DEATH OF MR. C. J. ADDISCOTT.

It is with deepest sorrow that we have to announce the death of our good friend Mr. C. J. Addiscott, Ex-President of the National Union of Teachers, and a valued contributor to the columns of the PRACTICAL TEACHER. In another page of this issue is recorded the death of Mrs. Addiscott, on October 9th, after a long period of failing health. Now, as we go to press, comes the sad news that less than a fortnight later, at half-past six on Friday evening, October 21st, Mr. Addiscott passed away. It seems probable that he never really recovered from the terrible shock caused by the loss of his wife; for, though, brave man as he was, he struggled with his school duties till Tuesday afternoon, he became seriously ill on Wednesday and grew rapidly worse till two days later he succumbed to heart-spasm or angina pectoris.

Everyone who knew him will keenly feel Mr. Addiscott's death as a personal loss; and the loss it means to the National Union we regard as incalculable. For, in his efforts on behalf of his profession he was untiring, never sparing himself, nor ever seeking his own personal ends. Seeing clearly, he laid down definite lines of educational and professional policy, and then followed them bravely and persistently, even though he might encounter strenuous opposition. But however much any teacher might differ from him, none we think could ever feel unfriendly. His was a high-strung nature, a 'spirit touched to fine issues,' and with a mind capable of forming noble ideals, he had a will strong to carry them into practice. Perhaps the physical constitution, good as it appeared to be, was hardly equal to the strain that his appetite for work placed upon it. He seems to have constantly acted on the belief that 'change of work is rest,' or, at least, an equivalent for it; and those associated with him tell us he never allowed himself an idle moment. Before Union work absorbed so much of his time, he spent his spare hours in painting, and the study of languages; and none but those who can sympathise with his love of art and letters can estimate what sacrifices a man of Mr. Addiscott's refined tastes and modest and retiring disposition must have made to leave his books and pictures and come into the arena of public controversy. Of course there have been some compensations. He has gained the respect and good-will of all his fellow-teachers, he has received some honours at their hands,

THE LATE MR. C. J. ADDISCOTT.

and has ever worn them worthily. Little more than a month ago he was elected a Fellow of the Educational Institute. His visits on behalf of the Union to conferences of teachers on the Continent have, no doubt, been much to his taste, and his genial cultured manner on such occasions must have produced excellent effects; and many teachers in foreign lands will mourn him as a dear friend. His own account of one of these expeditions appeared in the last number of this Journal.

Born in April 1843, Mr. Addiscott was only in his fifty-sixth year. Yet it may be held that he had lived a full life, a life rich in many interests, a life of intense action, governed by lofty ideals, and blessed with abundant achievement. And while deploring his loss to ourselves, and sincerely condoling with his sorrowing sons in their double bereavement, may we not believe that heaven mercifully shortened the interval of separation from the devoted sharer of his earthly life, and so ordained that the two souls so long bound up together should pass as companions into the life beyond?

Many details of Mr. Addiscott's life and work appeared in the PRACTICAL TEACHER for February 1897.

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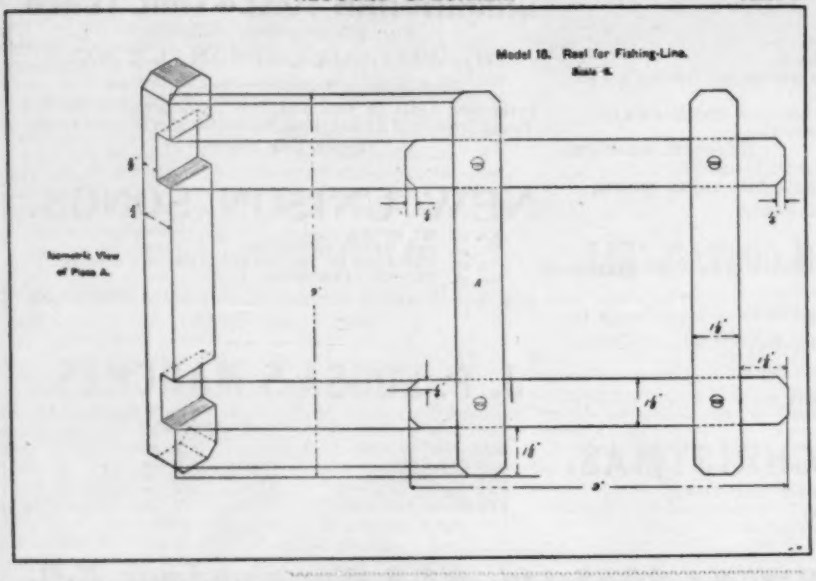

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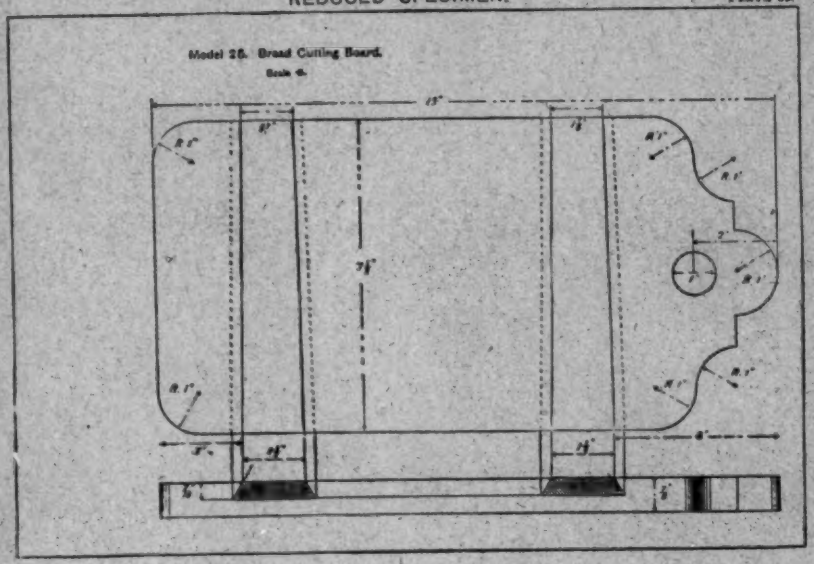

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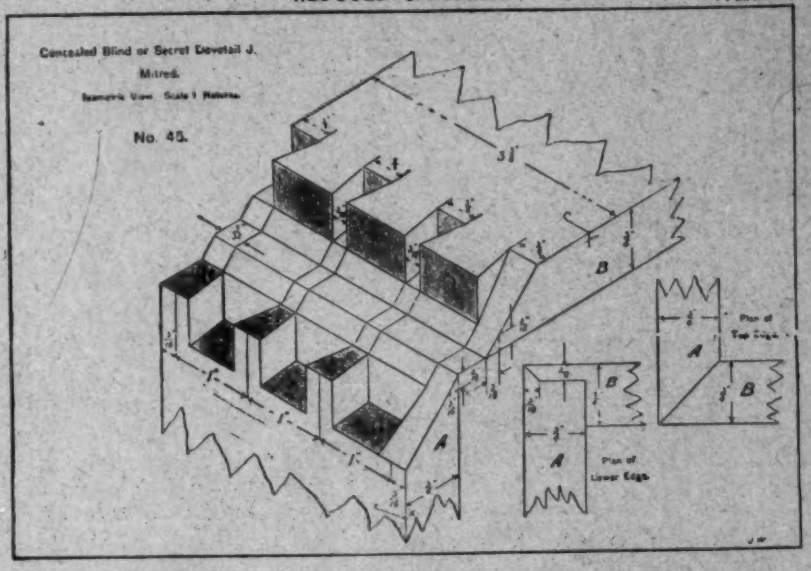
The list of tools required for each model is given for teaching purposes.

REDUCED SPECIMEN. PLATE 63.



The reduced specimen of Plate 27 shows the happy way in which a joint previously worked is applied to a useful purpose. No boy who has made for himself this fishing-line reel will ever forget the "half lap." Parts 2 and 3 are similar in character, but with appropriate increase in the amount of difficulty. The reduced specimen of Plate 38 shows a second year's model, and that of Plate 63 illustrates the class of joint work prescribed in the third year's course. The working directions [*see* Books] are purposely not intended to give instruction in every little detail of tool manipulation. They are simply general guides, and are not by any means designed to supplant practical illustration by the teacher, as this is the soul of Education through manual instruction.

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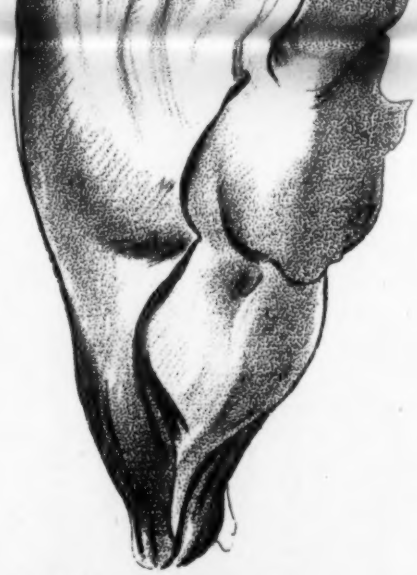

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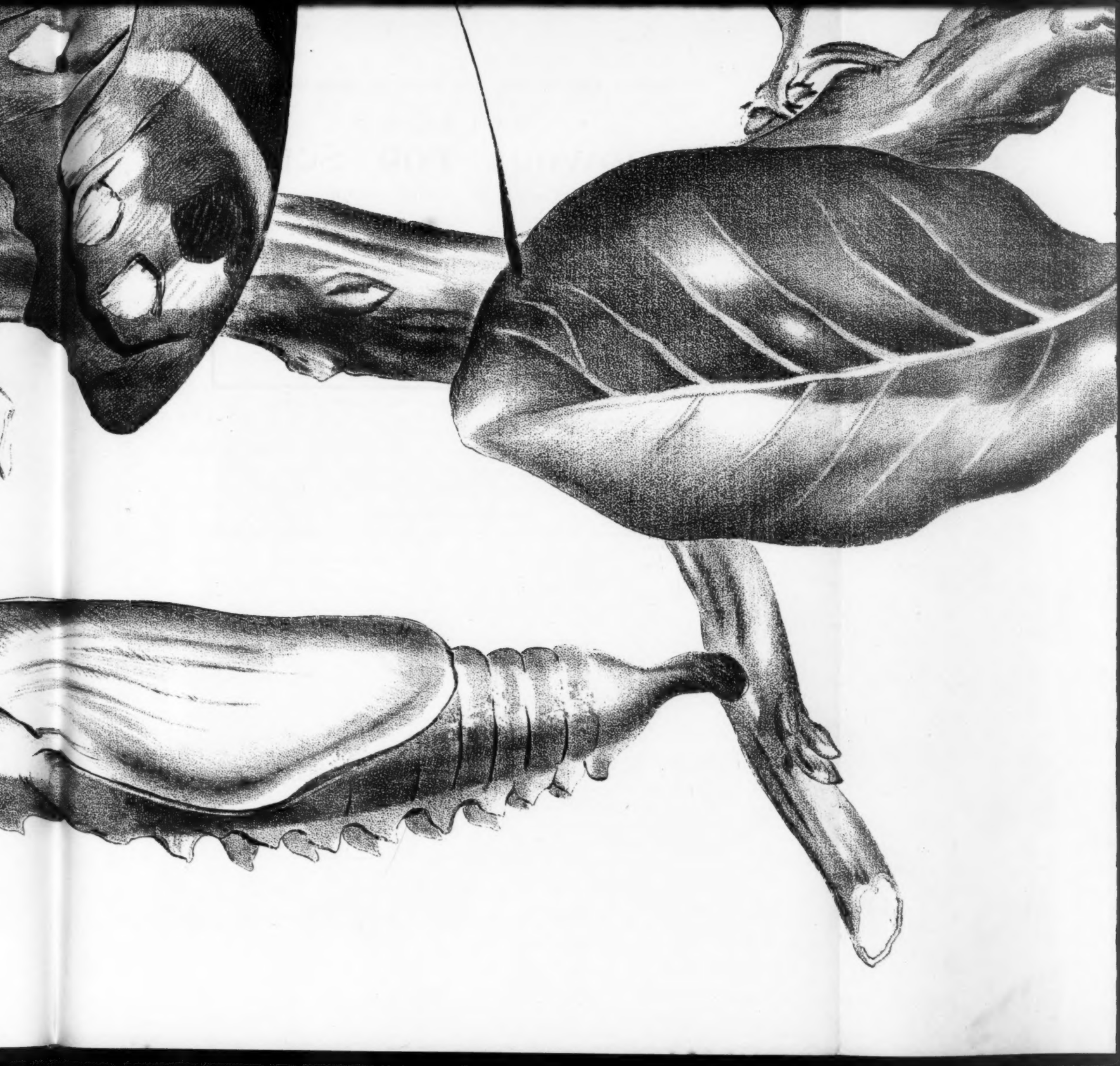

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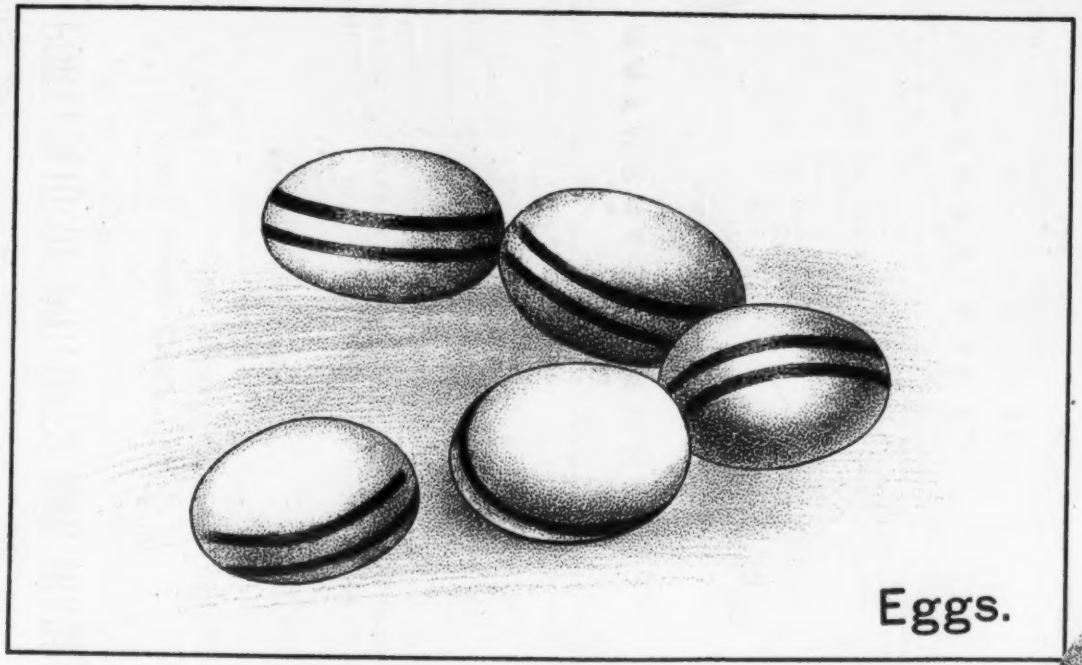
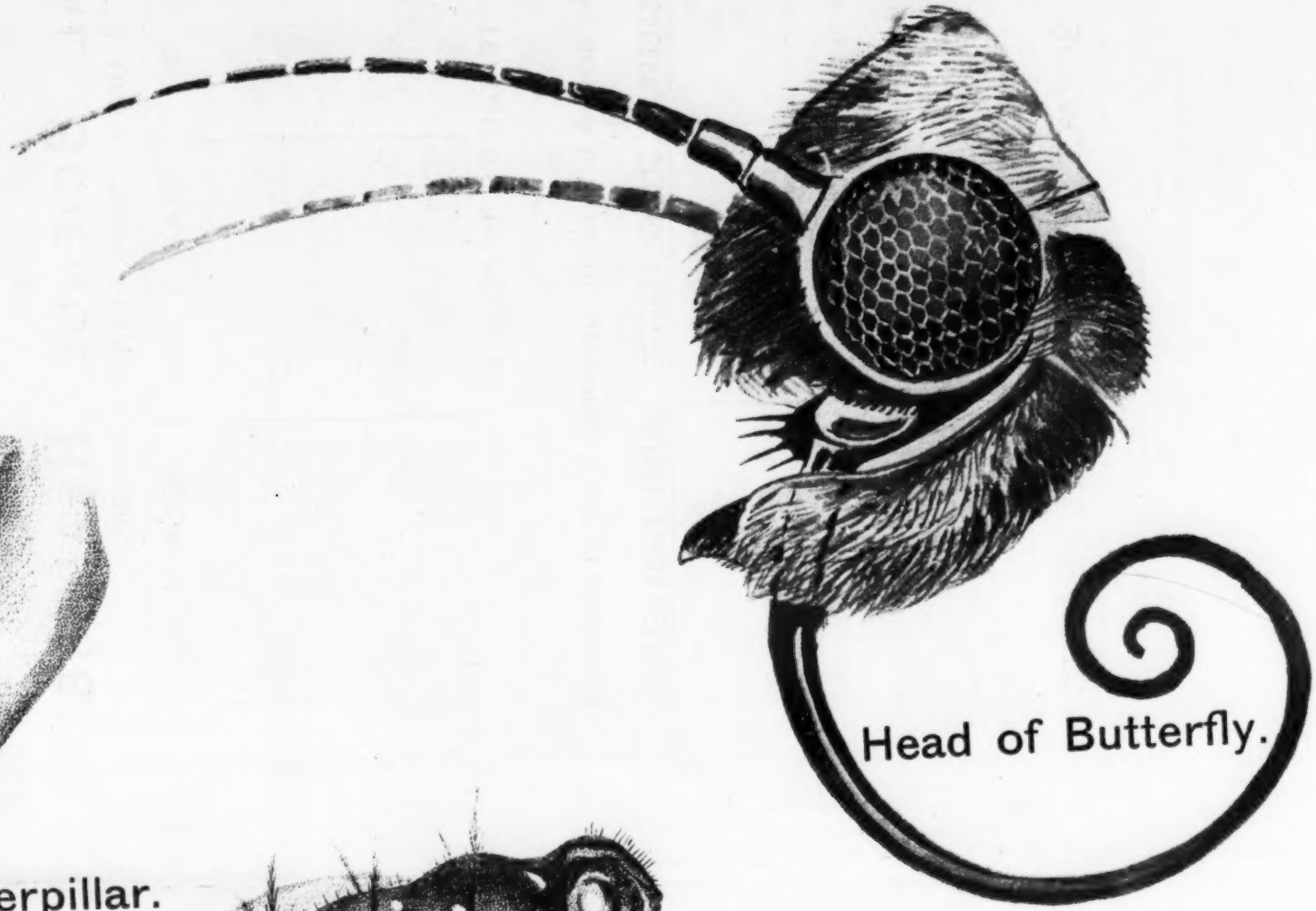


Eggs.

Caterpillar.



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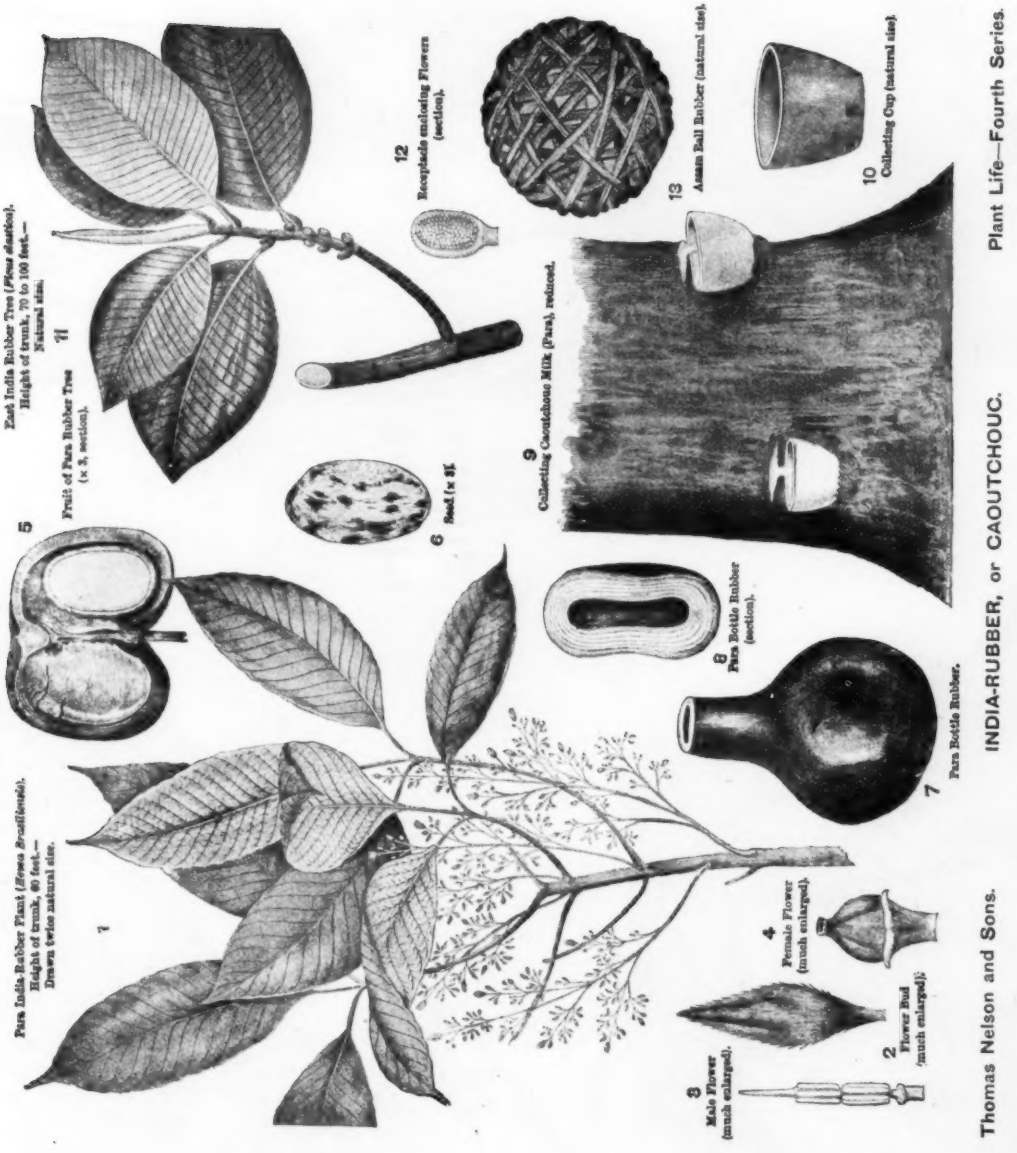

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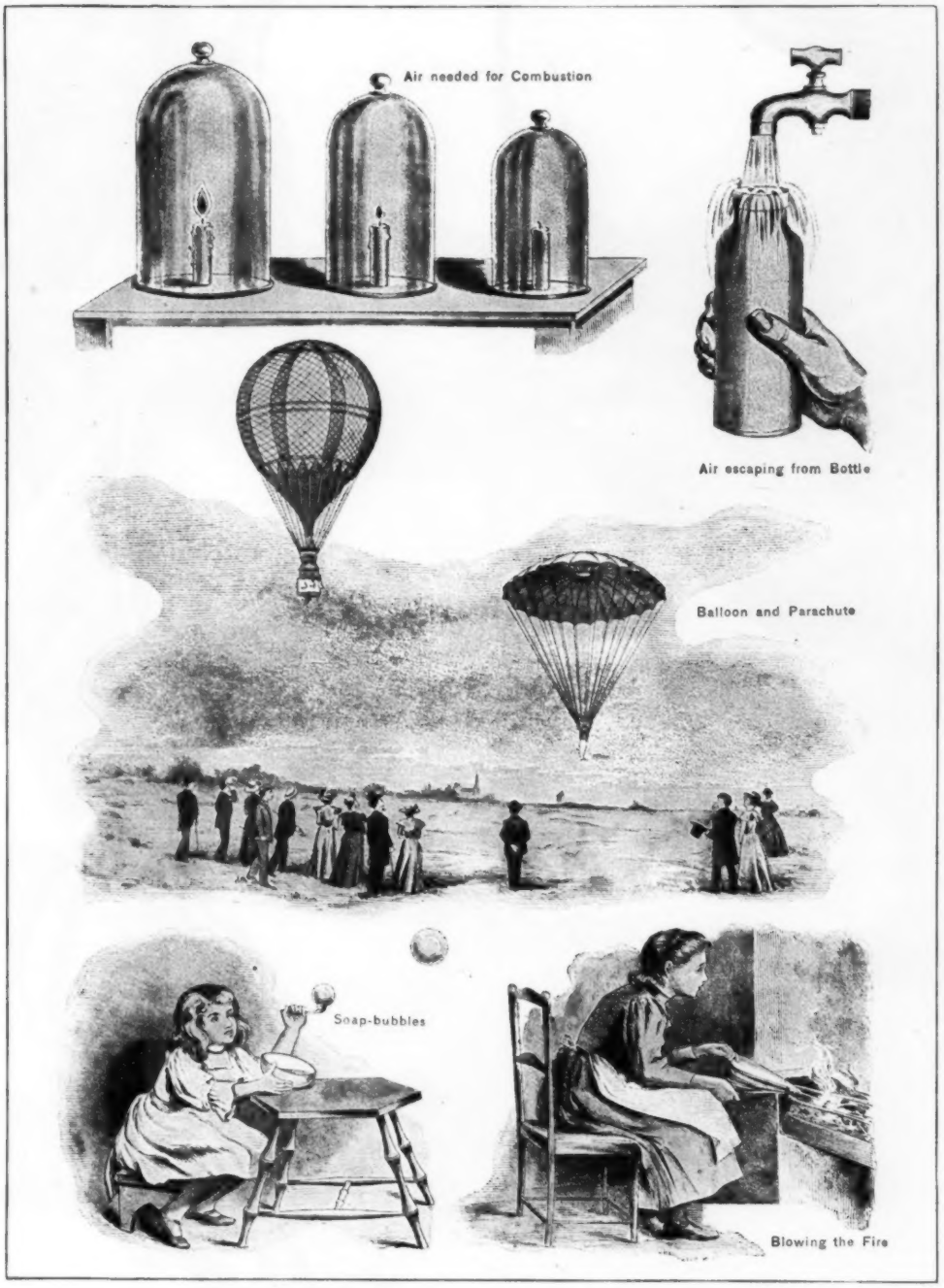

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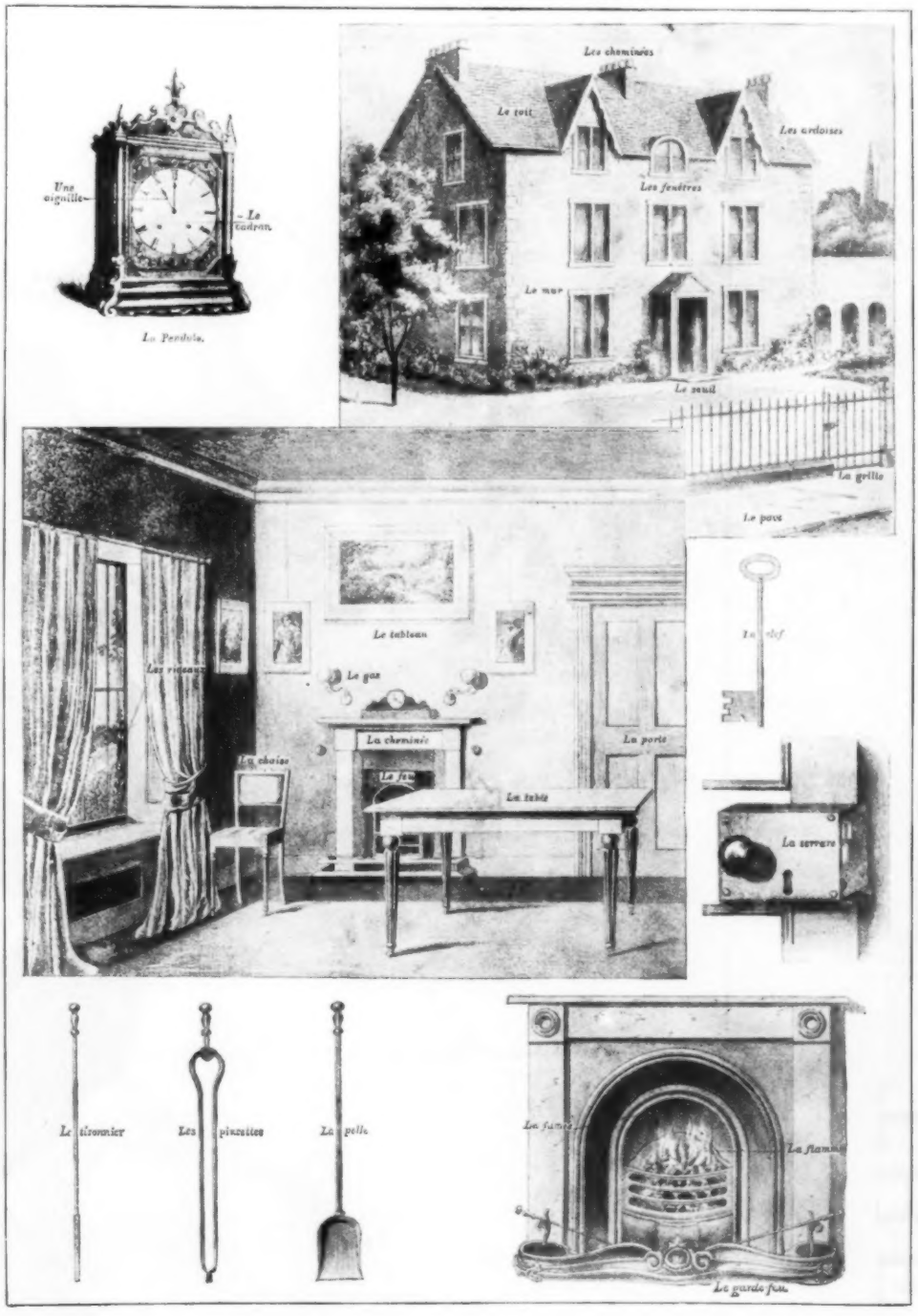

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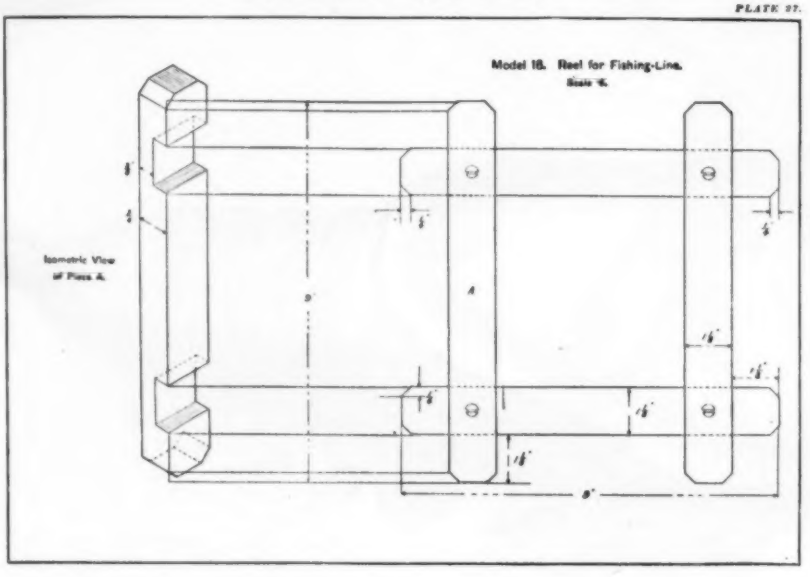
***Specimen of Plate* (*reduced*).**

PLATE 27.



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